PRESS

52nd YEAR

K. P. EWING
"Mr. Insect Control"

4th annual
Cotton Insect
Control Issue

Entered as second-class matter February 4, 1905, at the Post Office at Dallas, Texas, Under Act of Congress of March 3, 1897

Fifty years of steel making IN and FOR the SOUTH

March 5, 1951, marks the Golden Anniversary of Atlantic Steel Company.

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Founded by a small group of business men who had faith in the future and a desire to help build the South they loved, Atlantic Steel Company stands today a tribute to their vision.

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This Issue Is Dedicated to

K. P. EWING

"Mr. Insect Control"

. . . for his outstanding accomplishments in the field of insect control, with special emphasis on the early season phase of the program and his successful efforts in demonstrating the value of controlling cotton pests on a community-wide basis.

THIS ISSUE of The Cotton Gin and Oil Mill Press is a special issue in more ways than one. First, it is the fourth such issue that deals with the vital subject of cotton insect control, now more widely accepted than ever before as one of the more important steps in efficient, profitable cotton production.

Second, it has special significance in that it is the largest issue in the more than 51 years the publication has served the ginning and oil milling industries. That fact alone underlines the mounting interest in the successful control of cotton pests that has reached unprecedented heights in the past three or four years.

Third, it is a special issue because it takes special note of the outstanding accomplishments in the field of cotton insect control by the Bureau of Entomology and Plant Quarantine's K. P. Ewing of Waco, Texas, the man pictured on the cover. Because of his important contributions in this field, The Cotton Gin and Oil Mill Press takes special pride in dedicating this issue to him.

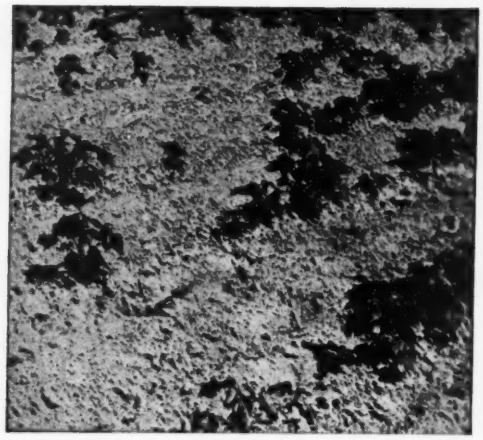
Ky Pepper Ewing—"Mr. Insect Control"—has been busy at his job of devising better methods of killing cotton pests for the past 30 years, 24 of which he has spent in Texas. His entire career has been marked with a very solid kind of success, but what has really distinguished his work at the Bureau's Waco Cotton Insect Control Laboratory is the new proof he has given to the old theory that early-season, pre-square, "preventive" control pays big dividends in higher acre yields in many sections of the Belt in most years.

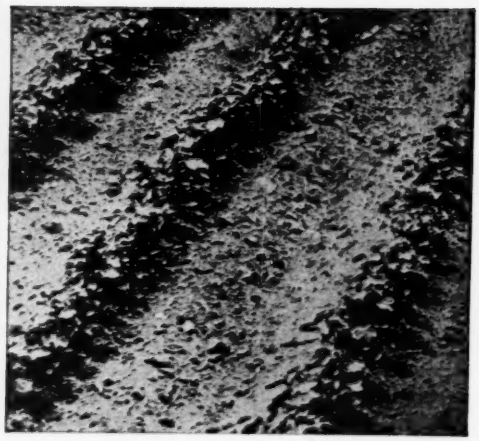
K. P. Ewing has also been the foremost exponent of conducting the entire insect control program, including early fall destruction of cotton stalks, on a community basis. Elsewhere in this issue he and an associate at the Waco laboratory, C. R. Parencia, Jr., give the 1950 results obtained through an early-season community-wide insect control program in two communities near Waco, Texas.

The Texas edition of The Progressive Farmer in its January, 1951 issue named K. P. Ewing Texas "Man of the Year" for 1950 for "the notable part he has played in making cotton insect control more effective." In 1949 the U.S. Department of Agriculture honored him and the Waco laboratory with one of its superior service awards "for outstanding achievements in the development and application of new insecticides for the control of cotton insects."

While we make special recognition of K. P. Ewing's important work in the field of insect control in this issue, we are fully aware, as we know all our readers are, of the very valuable work that is being done by many others who share with Mr. Ewing the great responsibility of improving our insect control techniques. These men can be found in the Bureau of Entomology and Plant Quarantine at Washington, in the state extension services and the state experiment stations. Each in his own field is contributing importantly to our growing knowledge of insect control.

To them, to K. P. Ewing—our congratulations on a job well done and a pledge to them from this publication of continued strong support of their efforts to aid the farmer to produce cotton more efficiently and more economically . . . through the effective control of insects.





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GET YOUR aldrin NOW!

Be ready to KILL COTTON INSECTS in HOURS instead of days

Over 2,000,000 pounds of this powerful cotton pest killer were used during 1950 (aldrin's first season)!

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2. aldrin controls these pests with *just 4 ounces per acre* on mature cotton . . . one to two ounces in early season.

aldrin kills in hours instead of days! Cotton pests die within a few hours after aldrinizing. Growers are enthusiastic about such fast action which cuts crop damage. Insects on *four acres* are quickly controlled with *just one* pound of aldrin.

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Your dealer will gladly give you more information on aldrin. *Don't wait—now's the time to decide.*

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Aldrin is manufactured by Julius Hyman & Co., and is distributed by Shell Chemical Corporation, 500 Fifth Avenue, New York 18.

Aldrin is available under the brand names of leading insecticide manufacturers. Consult your local dealer and county agent.

THE COTTON GIN AND OIL MILL

PRESS

52nd Year

THE MAGAZINE OF THE COTTON GINNING AND OILSEED PROCESSING INDUSTRIES

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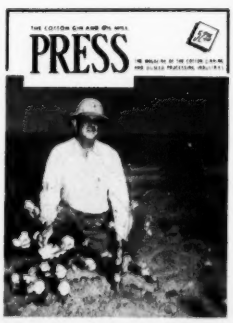
The Cover

"MR. INSECT CONTROL," pictured on the cover, is recognizable to many of our readers as USDA-BEPQ's K. P. Ewing, who is in charge of the Bureau's Cotton Insect Control Laboratory at Waco, Texas. In helping farmers to make more money out of cotton through the development of better pest control methods, Ky Pepper Ewing has, at the same time, been instrumental in making the cotton crop more profitable for ginners, crushers, and all others who are a part of the great cotton industry. There is more about K. P. Ewing and his accomplishments on page 7 of this issue.



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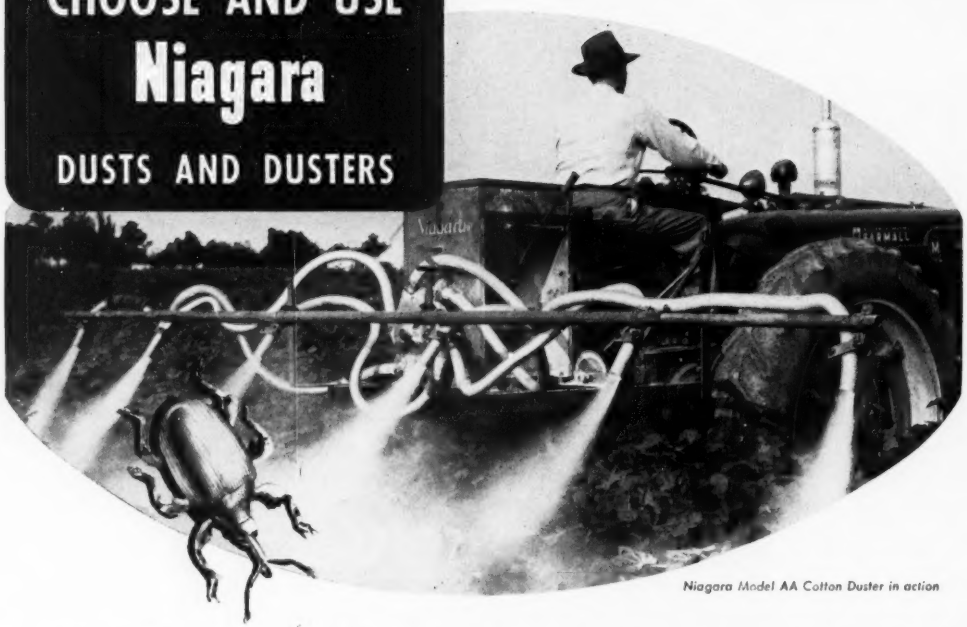
CHOOSE AND USE Niagara DUSTS AND DUSTERS



Niagara Model AA Cotton Duster in action

A Reliable Combination for Cotton Insect Control

HERE IS WHY YOU CAN DEPEND ON NIAGARA COTTON DUSTS

- **Economical—Niagara cotton dusts distribute evenly and dust well**
- **Highest insect killing power**
- **Laboratory controlled quality**
- **Field tested**
- **Approved by cotton planters throughout the South**
- **The right dust formulations, properly made**
- **Field service by Niagara representatives who are cotton insect control specialists**
- **Manufacturing experience—A pioneer producer of cotton poisons, Niagara has 47 years of experience in the production of insecticides for cotton.**

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Kolo Three-N-One Cotton Dust
Three-N-One Cotton Dust
(BHC-DDT-Sulphur)

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Two-N-One Cotton Dust
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BHC Dusts and Sprays—
Niatox (DDT) Dusts
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CUT FUEL COSTS IN HALF

when GM Diesel took over

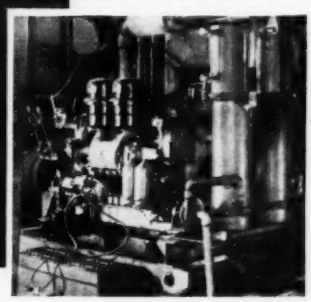
WHEN the Evergreen Gin switched from steam to GM Diesel power, a lot of things happened.

First, fuel costs were cut in half. Maintenance nose-dived. No fireman was needed. The gin was ready to go at the touch of a button. And, very important, a fire hazard was eliminated.

Manager W. T. Chapman, who ginned his first bale of cotton in the Evergreen Gin in 1912, says, "The GM engine is more satisfactory in every way. You couldn't *give* me a brand new steam engine today."

GM Diesels are 2-cycle engines with power on every piston downstroke. They're smooth, quick starting, pick up their load fast, and plug along day in and day out with little attention.

Cotton ginners everywhere are astonished at the money GM Diesels save them. It's sure worth looking into. Let us see that you get full details.



A GM Series 71 Diesel "Twin 6" provides surplus power for 4-80 gin of Evergreen Gin Co., Inc., Evergreen, Alabama—will easily power 5 stands plus additional drying equipment. Mr. Chapman's daughter Catherine, who is cotton grader for Evergreen Gin, is shown with her father

DETROIT DIESEL ENGINE DIVISION

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For prompt, reliable deliveries, order from Phillips . . . the world's largest producer of hexane. Write us for complete information about Phillips solvents . . . for soybean, cottonseed, flaxseed, tung nut, rice bran, corn germ, castor bean, alfalfa, animal fat and other oil extraction industries.

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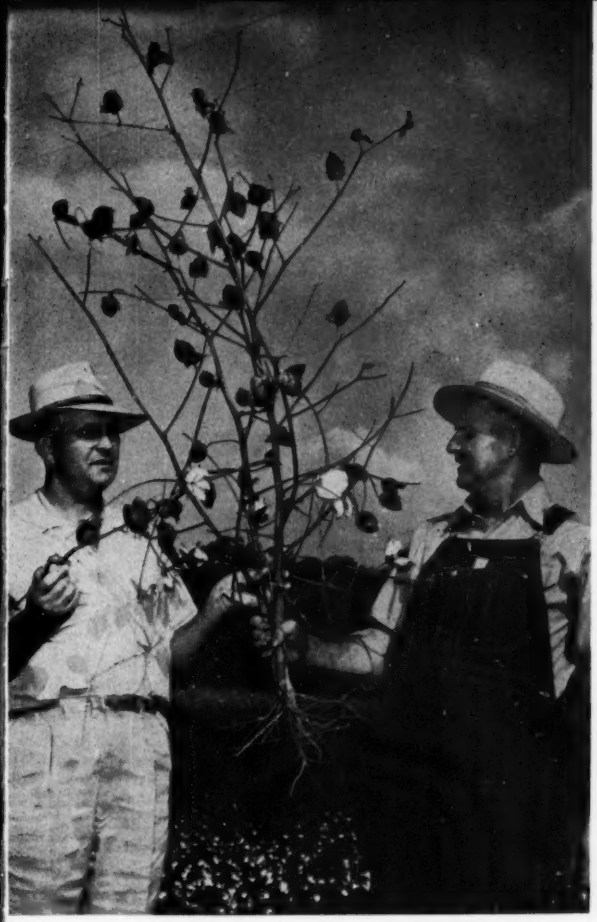

BIG YIELDS can be obtained even in a bad insect year when the right poisons are properly applied. Here County Agent C. I. Smith, left, of Kosciusko, Miss., and D. W. Eakin, manager of the Attala County Farm, observe the results of proper poisoning and defoliation. They counted about 60 bolls on this typical stalk from a field yielding about two bales per acre.

Insect Control In 1951...

A YEAR OF OPPORTUNITY FOR COTTON

AMERICA'S cotton farmers have been asked by their government to produce a 16-million-bale crop in this crucial year in our country's history. They can meet that goal, and WILL meet it, if they are given the necessary tools to produce the crop.

By IVAN J. CAMPBELL
Editor, The Cotton Gin and Oil Mill Press

BELTWIDE, 1950 was not a good cotton year. Acre yields generally were low, and in some places growers had complete failures. Unfavorable weather, as it often does, contributed to the reduction from full yield, but the greatest damage was caused by cotton insects, principally the boll weevil.

Looking back to 1950, we find that, even in those states which suffered the greatest damage, many farmers set new acre yield records on their own farms through the use of approved pest-control practices.

The record of these farmers is impressive. Many of them, because their neighbors poisoned not enough and sometimes not at all, were forced to apply poisons up to 15 times and more, but they still made handsome profits from their production.

Maximum benefits were obtained, of course, by those growers who were members of community action teams that planted early, poisoned early, and thus harvested high-quality lint and seed ahead of those communities that had no coordinated plan of action. Naturally, where there was community action growers applied less poison fewer times at less cost. The result was more net income per acre.

We have come a long way in cotton insect control in the last three or four years, and today there is keener interest in the subject than ever before. The unprecedented swing to this profitable step in cotton production invites some analysis. The development of the new organic insecticides is, of course, largely responsible for the swing to insect control, but in our opinion the development of highly effective spray formulations and improved equipment for applying them are factors of equal importance.

Dusts, it should be emphasized, are effective insect killers, but it is the sprays that have taken much of the drudgery out of insect control and made it possible to apply poisons at the time they are most needed. The swing to sprays has been especially heavy in Texas and those areas where high winds often make it impossible to apply dusts at the times they are needed.

Greatest damage to cotton by insects in 1950 was in North Carolina. The National Cotton Council in an unofficial estimate figures that the reduction from full yield in the Tarheel state due to insect damage was 35 percent. Next highest losses were in neighboring South Carolina and in Alabama, where insects reduced the full yield by 28 percent.

Running down the list of the other states, we find these losses, from the lowest to the highest, to insects in 1950: Arizona, one percent; California, two percent; New Mexico, three percent; Missouri, seven percent; Texas, 11 percent; Tennessee, 13.5 percent; Arkansas, Oklahoma and Virginia, each 17 percent; Louisiana, 18.5 percent; Florida and Mississippi, each 20 percent; and Georgia, 27 percent.

Still using Cotton Council preliminary figures, we find that the U.S. as a whole lost 16.5 percent of its cotton crop to insects. This loss, translated into products, amounted to 2,545,409 bales of cotton and 1,052,739 tons of seed with a combined value of $598,564,615.

What about insect control and insect losses in 1951? If it were not for the war, we would not have been asked to produce a 16-million-bale crop this year. But we do have a war on our hands, and therefore need the cotton and seed from a crop of that size. Still, war brings shortages and, unfortunately, it may mean growers will not be able to

obtain enough poisons to do the kind of insect control job that ought to be done. The insecticide industry (see article in this issue by Lea S. Hitchner on the insecticide supply situation) is fully aware of its responsibilities in helping to meet the 1951 production goal and is doing its utmost to provide cotton farmers with adequate supplies of poisons to produce the 1951 crop.

Much has been written and much has been said about the need for a 16-million-bale crop this year. The need is real and it is urgent. When the Secretary of Agriculture called for a crop of this size several months ago, after a thorough discussion of the problem with the Cotton Mobilization Committee, Cotton Belt farmers began immediately to make plans to meet the goal. They are fully aware of the fact that this country and our friends abroad who stand by our side in resisting the spread of communism cannot hope to meet that threat successfully if the cotton farmer fails to meet the challenge.

Claude L. Welch, director of the National Cotton Council's Production and Marketing Division, points out in an article in this issue: "The farmer is being asked to accomplish the tremendous job under abnormal conditions created by stepped-up mobilization. Though cotton is second only to steel as a vital war material, the farmer who grows this critical fiber will find competition on every hand for the very necessities with which to produce his crop. Industries which produce agricultural chemicals such as insecticides, fertilizers and defoliants, those which manufacture his farm implement, those which move his crop to market—all will be called upon to turn some of their production to military needs." Therefore, in view of the shortages that may develop in the supplies needed to produce the crop, it is essential that farmers utilize available materials and equipment in the most efficient manner possible. Every approved practice in efficient cotton production must be followed as closely as conditions will permit, with special emphasis placed on the most economical use of insecticides. Growers should follow the control recommendations of their own state and be careful not to use dosages in excess of the recommendations. It is equally important, of course, that dosages are not below those recommended.

If we plan wisely and develop a workable method of distributing materials to places where they are needed when build-up is heavy, we may have enough to go around.

The remarkable results that have been obtained through community action in planting early, poisoning early and destroying cotton stalks early have been widely publicized throughout the Belt, and hundreds of communities will follow this outstanding plan for the first time this year.

Special emphasis should be placed on the early-season control phase of the community action plan. For early poisoning not only results in higher yields, but it has the added advantage, of great importance this year, of conserving poisons.

Those who are charged with the responsibility of helping to guide the cotton farmer down the road to efficient, profitable production this year are urged to read the information-packed articles in this special insect control issue. These articles cover practically every phase of the control program and represent the best thinking in the country today on the subject.

Cotton insects in many years are the greatest limiting factor in producing the cotton crop. Cotton farmers this year simply cannot afford to let insects cause any appreciable reduction in yield.

It is still too early to make hard-and-fast predictions about the supply situation. We may suffer serious shortages in some materials and have ample supplies of others. Or, we may find that adequate supplies are available for a crop grown under favorable weather and insect conditions.

No one, however, should make the mistake of assuming that the cold weather in the Belt this winter will materially reduce the boll weevil population. Given snug winter quarters, the weevil is not likely to suffer much harm from subfreezing temperatures. His numbers may have been depleted somewhat, of course, but it would be foolish for any farmer in the boll weevil area to take the position that the weevil is done for. The boll weevil is an extremely difficult insect for weather to dispose of, and those who are wise will proceed on the assumption that he will show up on schedule, ready and willing to make life miserable for those who are unprepared to resist him.

If insecticide supplies and application equipment are ordered early . . . if the state control recommendations are followed carefully . . . if all of us carry out our individual responsibilities in the control program . . . 1951 can be a good year for cotton, at least from the standpoint of insect control.

In an effort to encourage maximum production of cotton and the proper timing and application of insecticides, billboards sponsored by the manufacturer of ALDRIN and DIELDRIN will carry the following message to cotton growers throughout the South:

Use State Recommended ALDRIN

FOR COTTON INSECT CONTROL . . .

ALDRIN ASSURES FASTER KILL, MORE EFFECTIVE AND ECONOMICAL CONTROL OF BOLL WEEVIL, THRIPS, PLANT BUGS, COTTON FLEAHOPPERS AND GRASSHOPPERS AT THE AMAZINGLY LOW DOSAGE OF FOUR OUNCES TO THE ACRE. WE WILL BE GLAD TO SUPPLY COMPLETE INFORMATION ABOUT ALDRIN AND DIELDRIN FOR COTTON INSECT CONTROL ON REQUEST.

Julius **HYMAN** *& Company*
DENVER, COLORADO

SHELL CHEMICAL CORPORATION, Distributor of unformulated ALDRIN and DIELDRIN in the United States.

Relation of the BUREAU OF ENTOMOLOGY And PLANT QUARANTINE to The COTTON INDUSTRY

By AVERY S. HOYT

AVERY S. HOYT

The BEPQ and its staff of researchers and field men keep constant vigil to guard our borders against the invasion of hundreds of cotton pests that do not now occur in this country.

COTTON GROWERS have just experienced what would have been the two worst cotton insect years in the history of the United States. Had it not been for the effective use of hundreds of millions of pounds of insecticides on millions of acres of cotton, these would have been without doubt the two years of greatest damage ever recorded.

There is no reliable method of predicting how serious cotton insects may be in 1951. In 1949 about 16,000,000 bales of cotton were produced on some 26,000,000 acres. The reduction from full yield caused by insects that year in the thirteen States where the boll weevil occurs was estimated at over 19 percent. We cannot assume that insects will be less abundant in 1951 than during the two previous years. Therefore, to meet the 16,000,000 bales the industry has been called upon to produce this year, every possible effort must be made to reduce the losses caused by insects.

The Bureau of Entomology and Plant Quarantine carries on a number of activities that are of special value to the cotton industry. These activities will have an important part this year, as they have in the past, in helping to reduce the amount of damage caused by cotton insects.

An important activity is that aimed at keeping new pests out of this country. In the cotton fields of China, India, Egypt, Turkey, Greece, the Belgian Congo, Rhodesia, Brazil, Peru, Venezuela, Colombia, and all of the other cotton growing areas in Asia, Africa, Europe, South America, Australia, the East Indies, and the West Indies there are hundreds of pests of cotton that do not now occur in the United States. They must be kept out of this country and the Foreign Plant Quarantine inspectors of the Bureau are doing everything that is humanly possible to keep them out.

The author is Chief of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington.

During the past sixty years only three serious foreign pests of cotton have become established in parts of the United States. The boll weevil arrived by natural spread from Mexico in 1892 and it took thirty years to become established in Texas, Louisiana, Oklahoma, Mississippi, Arkansas, Alabama, Florida, Georgia, Tennessee, South Carolina, North Carolina, and Virginia. The Bureau cooperated with the States in enforcing quarantines which helped to retard its spread. The pink bollworm, long known as a serious pest of cotton in India, was carried to Egypt and then to Mexico before it finally was discovered in the United States at Hearne, Robertson County, Texas, in September 1917. The Bureau cooperated with State agencies in eradicating the pink bollworm from Robertson and several other counties in Texas. Except for the natural flight of the moths from Mexico into Texas and from the West Indies into Florida, the pink bollworm would probably have been kept out of the United States by the quarantine and control measures that have been so effectively used against this pest. Although the pink bollworm situation in Texas, Oklahoma, and Louisiana is now more serious than ever before, the Bureau is cooperating actively with the States in the fight against this pest and the situation is not hopeless if all agencies continue to cooperate to the utmost in this fight.

The white-fringed beetles probably came from South America and were not known to the pests of cotton or other crops until they were discovered on farms in Alabama and Florida about fifteen years ago. The Bureau, in cooperation with agencies in the infested States, has checked the spread of these beetles, has eradicated them from some areas, and has developed effective control measures that may be used by the farmers.

The cotton industry has been protected by the persistent fight made by State and Federal workers in controlling and checking the spread of these cotton pests —the boll weevil, pink bollworm and white-fringed beetles.

Federal research entomologists work in cooperation with the State Agricultural Experiment Stations in South Carolina, Mississippi, Louisiana, Texas, and Arizona in developing methods, materials, and equipment for controlling the numerous insect pests of cotton. By following the recommendations of the research workers cotton farmers are now producing excellent crops of cotton in all areas in spite of heavy insect infestations. Cultural practices have been developed that aid greatly in holding down insect infestations, but at times insecticides are needed for the control of all the different pests of cotton. There are several insecticides that may be used for each cotton insect. Many formulations and mixtures of these insecticides are used because in nearly every cotton field there are several kinds of insects that need to be controlled. Some of the specific materials that are now generally recognized as effective for the different pests are:

Boll weevil—calcium arsenate, benzene hexachloride, toxaphene, aldrin, dieldrin.

Bollworm — DDT, toxaphene, calcium arsenate, cryolite.

Cotton aphid—nicotine, rotenone, benzene hexachloride, parathion.

Cotton fleahopper — DDT, toxaphene, benzene hexachloride, chlordane, aldrin, dieldrin, sulfur.

Cotton leafworm — calcium arsenate,

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GEIGY ALDRIN "25E"—(25% aldrin emulsifiable solution- 2 lbs. aldrin per gal.)

GEIGY "10-20" COTTON SPRAY—(emulsifiable solution—1 lb. aldrin, 2 lbs. DDT per gal.)

GEIGY E25—(25% DDT emulsifiable solution—2 lbs. DDT per gal.)

DUSTS

GEIGY 3-5 COTTON DUST—(3% BHC—5% DDT)

GEIGY 3-5-40 COTTON DUST—(3% BHC—5% DDT —40% sulphur)

GY-PHENE "20"—(20% toxaphene dust)

GY-PHENE "20S"—(20% toxaphene dust with sulphur)

GEIGY 2½% ALDRIN DUST

GEIGY 2½% ALDRIN—5% DDT DUST

GEIGY 2½% ALDRIN—5% DDT—40% SULPHUR DUST

Also available: alternate products, including chlordane formulations and calcium arsenate, should national supplies of the above materials become depleted.

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paris green, lead arsenate, benzene hexachloride, toxaphene.

Cutworms—toxaphene, dieldrin, paris green, sodium fluosilicate, cryolite.

Fall armyworm—toxaphene, DDT, benzene hexachloride, chlordane.

Garden webworm—DDT, benzene hexachloride, toxaphene, calcium arsenate.

Grasshoppers — aldrin, benzene hexachloride, chlordane, dieldrin, toxaphene.

Pink bollworm—DDT, methoxychlor.

Spider mites—sulfur, parathion, TEPP, Aramite, and several other phosphorus compounds.

Thrips — toxaphene, aldrin, benzene hexachloride, dieldrin, chlordane, heptaclor, DDT.

White-fringed beetles—DDT.

Wireworms—chlordane, DDT, lindane, benzene hexachloride.

It is thus readily apparent that as a result of recent research in which the Bureau scientists had an important part, cotton growers now have a wide range of insecticides from which to choose. This may be especially important during 1951 if shortages of several insecticides occur.

Research has also shown that under certain favorable conditions in some areas cotton growers may produce excellent crops of cotton by following recommended cultural practices to control the insect pests without the use of insecticides.

During recent years the value and importance of cotton insect surveys have been appreciated by an ever increasing number of farmers and others interested in cotton production. During World War II many farmers, county agricultural agents, extension entomologists, and insecticide manufacturers expressed appreciation for the Bureau's assistance in the cotton insect surveys which were conducted in cooperation with State agencies. The value of keeping the public in general informed concerning the occurrence, abundance, spread, distribution and methods of control of such major pests as the boll weevil, bollworm, cotton fleahopper, and cotton leafworm has been demonstrated. The surveys give some insurance of discovery before wide distribution of any new pest that may be introduced or spread accidentally or by some enemy of this country. As there are more than 1000 known species of cotton pests throughout the world that have not reached the United States, these surveys have greater value than is generally realized. In North Carolina, South Carolina, Georgia, Mississippi, Louisiana, Texas, New Mexico, Arizona, and possibly other States, reports are compiled and distributed at frequent intervals, usually weekly, that give the available information in regard to cotton insect conditions, and the insecticide supply situation. For several years the Bureau has compiled the data received from the different States and has distributed periodical reports during the summer on cotton insect conditions and the insecticide supply situation.

During each of the past four years the Bureau has invited entomologists and associated technical workers from the cotton growing States in the eastern half of the country to meet with workers of the United States Department of Agriculture in a Cotton Insect Research and Control Conference. These conferences have provided a forum for State and Federal workers to present the results of their research, observations, and experiences in cotton insect control. As a result of this exchange of information the conferees have each year prepared a report that has served as a guiding statement for cotton insect control recommendations for the ensuing year. This cooperative undertaking has proved extremely valuable to the cotton industry and to those members of the insecticide industry who provide the materials needed by the cotton growers.

In this brief discussion it has been possible to mention only a few of the ways in which the work of the Bureau serves the cotton industry. The Bureau will cooperate in doing everything possible to help the farmers produce the 16,000,000 bales of cotton that the Secretary of Agriculture has announced as the goal for 1951.

Canary Island Cotton Production Rises

Cultivation of cotton in the Canary Islands has expanded in recent years, according to William B. Snidow, American vice consul, Tenerife. Production increased from slightly more than 500 bales in 1949 to about 2,300 bales in 1950. The area planted to cotton in 1950 was estimated at 5,200 acres.

The government has guaranteed producers a price of 16 pesetas per kilogram (about 66 U.S. cents per pound) for their crop. There are no gins on the islands and all cotton produced has been sent to Spain for ginning. Plans for construction of a gin near the cotton fields, however, have been announced.

Laugh it off

Manager: I hear you and the leading lady are on the outs.

Electrician: Yeah! It was one of those quick change scenes with the stage all dark. She asked for tights and I thought she said lights.

• • •

"Was there much necking at the party?"

"Was there! Before the dance, the hostess announced: 'Everyone chews his partner'!"

• • •

Local Young Man: Just one kiss, dearest?

His Girl: No, dear, we haven't time. Daddy will be home in an hour.

• • •

A fat lady stepped on the scales, not knowing they were out of order. The indicator stopped at 75 pounds.

"Holy smoke!" exclaimed a drunk who watched her, "she's hollow!"

• • •

A retired baseball magnate used to enjoy getting out on the links with his minister. Most of the pleasure came, of course, from the fact that the older man could easily beat the preacher.

The minister took his lickings as long as he could and then complained to the old magnate. The elderly gentleman chuckled.

"Now, now," he chided. "Don't get upset. I may be beating you now, but you'll win out in the end. After all, you'll be laying me away for good one of these days."

"Maybe so," bitterly replied the minister, "but even then it'll be your hole."

• • •

"How about a date tonight?" asked a freshman of his beautiful female lab instructor.

"I can't go out," she said disdainfully, "with a baby."

The freshman blushed. "Excuse me," he said, "I didn't know your condition."

• • •

A lady turtle turned to friends and said, "Will you excuse me for five years while I go to the powder room?"

The others said they would, so she left, but returned in three years.

"How come?" asked her friends.

"Oh," said the first turtle, "there was someone else in there, and I decided not to wait."

• • •

Bill: Why is a fellow with a key to a girl's flat so indifferent?

Mary: Oh, he probably doesn't give a rap.

• • •

Missus Mandy Johnsing, surrounded by her brood of eleven or thirteen pickaninies, was talking to the spinster settlement worker. "Yes 'em, birth control am all right fo' you all, but me, ah's married and don' need it."

• • •

Goldie: Thank you so much for the lovely pearl necklace.

Married Man: Don't mention it, don't mention it, don't mention it.

CG&OMPress Photo.

THROUGHOUT THE BELT, in every cotton-growing state, there is a mounting awareness of the urgency that demands a more determined effort than ever before to economically control insects. Pictured here are North Carolina Extension workers observing the results of control efforts in their state last fall.

The 1951 State Guides for Insect Control

IT WILL BE FOUND that the state guides for 1951 are more complete and comprehensive than ever before. The entire cotton industry, every branch of which benefits from effective control of cotton insects, is indebted to the state and federal entomologists whose untiring efforts are responsible for the dependable information these guides contain. All who will have a part in the 1951 program are urged never to guess about how to control insects. When in doubt consult your county agent or some other qualified authority.

Control of Insects in—

• Alabama

Farmers in Alabama are going to try to produce their share of the 16,000,000 bales of cotton that the nation needs in 1951. To accomplish this, more acres of good land will have to be planted in cotton and the yield per acre will have to be increased. In order to increase the yield per acre these things must be done: (1) prepare land well, (2) use an adequate amount of the right kind of fertilizer, (3) plant treated seed of a good variety, (4) plant on time, (5) cultivate properly, and (6) control insects.

The failure of most farmers to control boll weevils during the past two years has resulted in low per-acre yields. The recommendations outlined here are made for boll weevils but, if followed, other major insect pests of cotton will be controlled.

Poisons to Use

The kind of poison used to control boll weevils and other cotton insects is no more important than *how* it is used. The following materials are recommended for general use in the control of cotton insects. Dust formulations include:

1. A 3-5 mixture of BHC-DDT.
2. Alternate applications of calcium

arsenate and a 3-5 mixture of BHC-DDT.

3. Alternate applications of calcium arsenate and calcium arsenate that contains 2 per cent nicotine.

4. 20 per cent toxaphene.

With added precautions these materials may be used: a mixture of (1) 2.5-5 per cent aldrin-DDT and (2) 1.5-5 per cent dieldrin-DDT. Aldrin and dieldrin have not been tested as long as other cotton poisons, but they have given good results for two years in Alabama tests. Aphids (lice) may build up where these mixtures are used.

Materials recommended for use as sprays include:

1. Toxaphene.

2. Toxaphene and DDT mixed in the ratio of 2 to 1.

3. BHC and DDT mixed in the ratio of 1/3 pound gamma isomer BHC and ½ pound DDT.

4. Aldrin ¼ pound mixed with ½ pound DDT.

5. Dieldrin 1/5 pound mixed with ½ pound DDT.

When to Poison

Dust or spray cotton when insects are present in large enough numbers to damage the stand or reduce yields.

Begin fighting boll weevils when cotton plants are fruiting freely and 25 per cent of the squares are punctured. Dust or spray every 5 days until three applications have been put on. After the third application, check each field every week. When you find 25 per cent or more of the squares punctured, put on three more applications 5 days apart. If poison is washed off within 1 to 18 hours repeat application as soon as possible.

When swarming weevils are found in blooms near the top of the stalk, apply poison every 4 days until top bolls are about grown.

When there are a large number of aphids on your cotton, use a 3-5 mixture of BHC-DDT or 3 per cent nicotine. Apply at the rate of 12 to 15 pounds per acre.

If there are enough bollworms to damage the crop, apply 10 per cent DDT or 20 per cent toxaphene at the rate of 15 pounds per acre. If you follow a good boll weevil control program you will not be bothered with bollworms.

In a dry year spider mites (red spider) may cause damage in small fields of cotton. If mites occur in numbers sufficient to damage cotton use poison that contains 40 per cent sulphur. Apply 15 pounds of poison per acre every time cotton is dusted until mites are controlled.

How to Apply Poison

You can apply cotton poisons as a dust or as a spray. Dust can be put on with hand, mule-drawn, tractor or airplane equipment. Spray can be applied by tractor or airplane.

Dust when the air is still and cotton plants are dry. Late in the afternoon is usually the best time to apply poison.

Dust formulations other than calcium arsenate are used at the rate of 10 to 15 pounds per acre. Apply calcium arsenate at the rate of 7 to 10 pounds per acre.

The amount of diluted spray used to cover an acre may vary from 2 to 10 gallons. The right amount of poison to use per acre for each application of spray (regardless of the volume of spray) is as follows:

1. 2 to 2½ pounds of technical toxaphene.

2. 1/3 to ½ pound of gamma isomer BHC plus ½ or more pounds of DDT.

3. ¼ pound of aldrin plus ½ pound of DDT.

4. 1/5 pound of dieldrin plus ½ pound of DDT.

The mixtures that contain aldrin and dieldrin are recommended for tractor or airplane spraying only.

Control of Insects in—

• Arizona

Practice Good Farming

Always prepare a good seed bed.

Plant as early as possible.

Follow recommended irrigation practices.

Set up a plan for adequate insect control.

Control of insects of cotton by new insecticides has proved to be very important. This is reflected by increased yields and better quality of cotton. The control of insects alone will not give the high yield or good quality, nor will following good farming practices. It takes a combination of good farming practices and insect control to give the desired results.

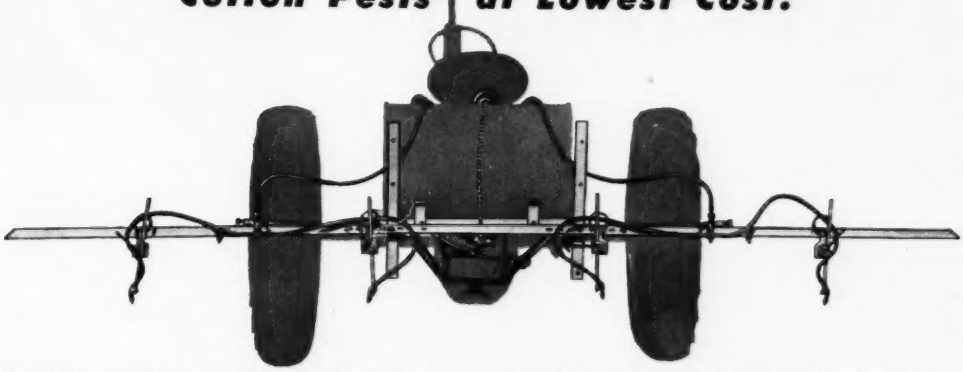
Learn to recognize injurious cotton insects and use a bug net (15-inch diameter) at several points in a field to determine if insects are present in harmful numbers. *Do not dust or spray as a preventative measure or just because your neighbor dusts or sprays.*

Dust applications should be started

(Continued on Page 49)

Get Bigger Yields of Better-Quality Cotton

New Myers Tractor Sprayer Controls Cotton Pests at Lowest Cost!



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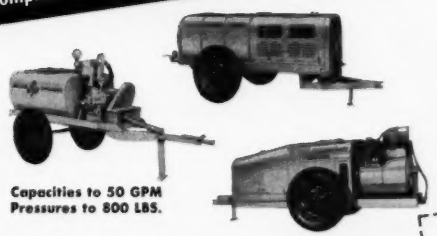

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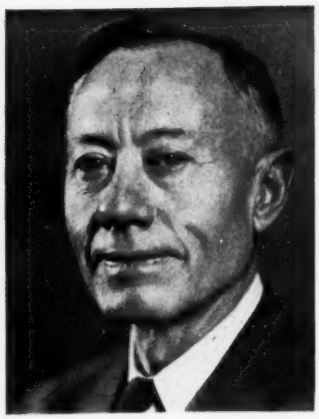
COTTON INSECT RESEARCH PAYS BIG DIVIDENDS

By F. C. BISHOPP



F. C. BISHOPP

IN THIS ARTICLE Doctor Bishopp shows how research has added to our store of knowledge in the field of insect control and increased the farmer's income from cotton by millions of dollars annually.

THE OPPORTUNITY to discuss some phases of Cotton Insect Research is appreciated. In my position as the official in charge of Research in the Bureau of Entomology and Plant Quarantine, I am always pleased to learn of instances where the practical application of information obtained by research has proved to be highly profitable to the persons who have used it. I am daily impressed with the fact that research pays big dividends. The large industrial and business corporations have long ago learned the value of research and the manufacturers of automobiles, chemicals, steel and glass and many other industrial organizations are investing millions of dollars each year for personnel, equipment and material for their research laboratories. They know that research pays big dividends.

The pink bollworm has long been the most difficult to control of all the important cotton pests. All the insecticides that have been used successfully against any of the pests that attack the gardens, field crops, orchards and forests of the Nation were tried against the pink bollworm. Each of them would kill some pink bollworms but none was sufficiently effective to be considered as of real practical value in pink bollworm control.

However in 1943, DDT was used for pink bollworm control and immediately it was found to be more effective than any insecticide previously tested for the control of this pest. A letter written on December 26, 1950 by Mr. Murrel F. Decker, a cotton farmer of Presidio County, Texas, to A. J. Chapman, Entomologist of this Bureau at Brownsville, Texas, is in part as follows:

"I finally finished picking my cotton crop and I thought it would only be right for me to write a thank you note for the wonderful vacation I had during the month of November. You may not know it but I feel that if my cotton crop had not had the wonderful poison program—I would not have been in position to have taken such a vacation."

Mr. Decker then writes in considerable detail of the yields obtained at the different pickings and continues:

"I sincerely hope the above information is not too mixed up for you to untangle but in very simple language the poison program will always mean one thing to me and I have renamed it to suit myself: The Mortgage Lifter.

"I would like to take this occasion to thank you and your organization for the benefits gained by myself and the farmers in the Presidio Valley."

Mr. Decker obtained 34,086 pounds of seed cotton and bollies from 8⅓ acres of cotton that had been treated with insecticides for pink bollworm control and 1564 pounds from 1½ acres of untreated cotton. His poisoned cotton produced at the rate of 4010 pounds of seed cotton per acre and his untreated cotton at the rate of 1043 pounds per acre. It is easy to see why he could take a vacation in November and why he calls the poison program The Mortgage Lifter. The 10 acres produced about $6000 worth of lint and seed.

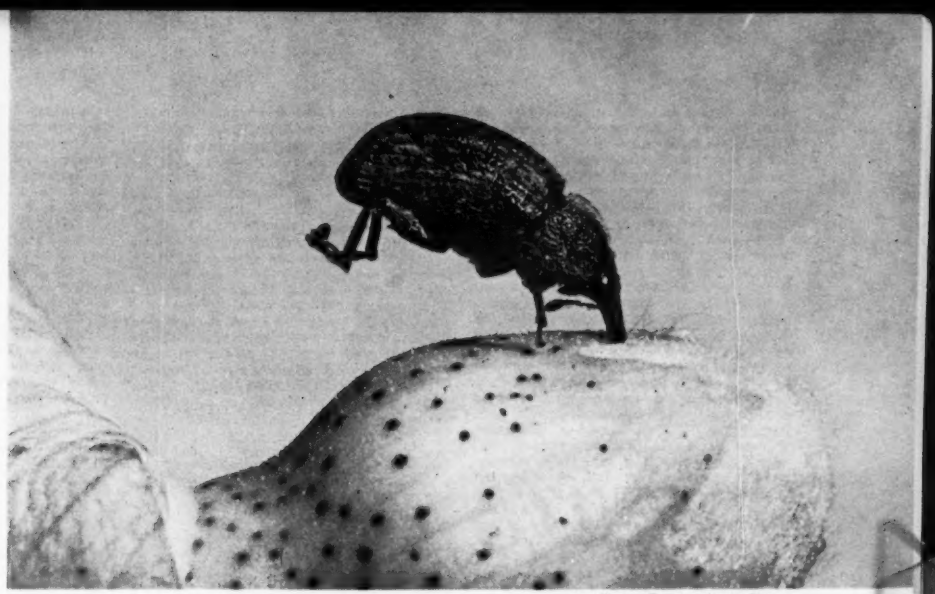
Probably in every county in the United States where cotton was grown in 1949 and 1950 there were farmers who followed the recommendations for cotton insect control developed by research who made wonderful yields and fine profits while many of their neighbors produced less cotton per acre than for many years. Many of the cotton growers in Mexico are following the results of research and are controlling the pests in their cotton fields. C. S. Rude reported from the Laguna District of Northern Mexico concerning the early-season dusting with insecticides of 2,125 acres on 7 widely separated ranches in 1950 where the applications of DDT were started when the cotton plants had only 6 to 8 leaves. These fields received 6 or 7 applications of insecticides. They were compared with 7 neighboring fields where the insecticide applications were delayed until 10 percent of the green bolls had pink bollworms and with two ranches where no insecticides were used. The average yield was 650 pounds of lint cotton per acre from the fields where the insecticide applications were started early, 540 pounds where the insecticides were not applied early and only 183 pounds of lint cotton where no insecticides were used. The lint from the early treated fields was of better grade than from the late treated and untreated fields. Early-season application of insecticides should be thoroughly tested in all areas where cotton is grown.

"Early-season control" of the boll weevil was widely recommended forty years ago but later investigations showed that when arsenical insecticides were used, the early applications were often not profitable. However, the new organic insecticides that control thrips, cotton fleahoppers, aphids and cutworms, as well as the boll weevil, have again made "early-season control" a popular recommendation.

This method of control is especially valuable against the boll weevil and its chief objective is to control the overwintering adults before they can reproduce. This greatly delays the late seasonal buildup and permits the plant to set and mature a full crop before the insect becomes abundant. About 90 percent of the crop is normally set during the first month of blooming; therefore, good insect control during this period is essential.

Early-season control is especially important in areas of low soil fertility. Under such conditions, combined with the present quick maturing varieties of

The author is assistant chief of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington.



A BOLL WEEVIL, "Mr. Big" of the cotton insect forces, digs in on a young cotton square.

Clemson Extension Service Photo.

COTTON INSECTS CAN AND MUST BE CONTROLLED IN 1951

By CLAUDE L. WELCH

IN 1951 the American cotton farmer will find his mettle tested to an extent that has been exceeded few times in the history of our country. A nation critically short of cotton is asking him to vastly step up his output—to produce 16 million bales to provide our military forces, civilians and friends abroad with the fiber they will need so desperately.

The farmer is being asked to accomplish this tremendous job under abnormal conditions created by stepped-up mobilization. Though cotton is second only to steel as a vital war material, the farmer who grows this critical fiber will find competition on every hand for the very necessities with which to produce his crop. Industries which produce agricultural chemicals such as insecticides, fertilizers, and defoliants, those which manufacture his farm equipment, those which move his crop to market—all will be called upon to turn some of their production to military needs.

As the cotton farmer turns to his mighty task he must marshal those qualities which are at a highest premium on the battlefield—those faculties of foresight, alertness, determination, inventiveness, adaptability and courage.

As the soldier adapts himself to the swiftly changing tactics on the line, so must the farmer adapt himself to the swiftly changing events on the home front. He must cope with labor scarcities, material shortages and weather.

No general would undertake a campaign without a battle plan, a strategy which is flexible enough to be adapted to swift and sudden change. The cotton farmer, likewise, if he is to accomplish his goal, must adopt such a strategy.

In producing a cotton crop, the farmer, of course, encounters a number of forces over which he has no control. On the other hand, there are some controllable factors which can mean the difference between high yields or an average or poor crop. These are such approved practices as wise land selection and preparation, selection and treatment of planting seed, fertilization, cultivation, insect control, defoliation, and proper harvesting and handling of cotton. The farmer can plan his operation so as to most effectively use the credit, labor and machinery which will be available.

In discussing cotton production, any one of the above subjects might well be treated in a full length article, but our

(Continued on Page 80)

CLAUDE L. WELCH

The author is director of the National Cotton Council's Production and Marketing Division.

MR. WELCH SAYS: "Cotton ginners, crushers and other members of the cotton industry can play a vital role toward bringing about effective control of cotton pests this year. Both an opportunity and a responsibility are presented more vividly in 1951 than ever before."

cotton, the crop matures early; therefore, the early crop must be protected to produce a full crop.

Early-season control has greatly reduced the number of insecticide applications needed for complete seasonal control of all cotton insects, thus materially decreasing the cost.

Also, early-season control advanced early fruiting and maturity of the cotton crop by two to three weeks, especially if thrips were abundant enough to cause serious injury. The need for crop protection has been reduced by this period of time, not only from the possible damage that might be caused by other insects and boll rots, but also from weather damage to the lint.

Under some conditions early season applications may afford adequate protection for the entire season. However, in case of severe infestation additional applications may be needed. The individual field or farm may receive considerable benefit, but the larger the area treated the more effective the early-season control program becomes.

The beneficial results of this method of control were demonstrated over a 3-year period in several locations in Texas. In this area, where the boll weevil and thrips are nearly always abundant in the spring, two to four applications of an insecticide are recommended at about 7-day intervals, usually beginning when the cotton is in the 4-leaf stage. These applications are made to control thrips, aphids, fleahoppers, or boll weevils, alone or in combination. The last early application should be timed to control the overwintering adult boll weevils, and applied when the oldest squares are about 1/3 grown. This application also greatly reduces the first generation of weevils.

In 1950, under the direction of K. P. Ewing and Charles R. Parencia, Jr., an isolated area near Waco, Texas, consisting of 3,602 acres on 36 farms, was treated according to the above program. Eighty-six acres received one application, 770 acres received two, 2,678 acres received three, and only 66 acres received four, or an average of 2.75 early applications and 0.25 late applications. The average cost of the early applications was only 78 cents per acre for each and $2 for each of the late applications. Complete seasonal control of all the injurious cotton insects in this area was made at a cost of only $2.65 per acre.

The increased production over an adjacent untreated area was 204 pounds of lint cotton and 301 pounds of cottonseed per acre, valued at $74.84. For every dollar spent for poison, there was a return of $28.24.

No one can determine the precise value of this development, but we do know that it will pay big dividends if the farmers growing cotton under similar conditions will follow the recommendations. The cost for complete seasonal control of all the injurious insects was greatly reduced over the previous method of waiting until ¼ of the squares were destroyed before insecticide applications were started, and losses from bollworms were reduced.

As a result of research on timing of insecticide applications for boll weevil control, several states in the Southwest are recommending applications of poison, beginning at squaring and continued at 7-day intervals for 3 to 6 applications to control the overwintering adults and the first brood.

Another outstanding example of early-season control might be cited from tests conducted in South Carolina during 1950 under conditions of a very heavy boll weevil infestation.

Experiments were conducted near Florence, South Caroiina, in six fields with a total area of about 30 acres. One-half of each field was dusted and the other half sprayed. Two untreated outside plots of ½ acre in each field served as checks.

The schedule of insecticide applications was as follows: 3 applications beginning at squaring at 7-day intervals, 3 applications beginning at blooming at 7-day intervals, and 4 additional applications beginning at 10 percent square infestation.

The yields in the dusted and sprayed plots were 1369 and 1410 pounds of seed cotton per acre, respectively, as compared with 407 pounds per acre on the untreated check plots. The cost of poisoning for the entire season was about $21.10 and $23.50 per acre for the dust and spray, respectively. There was a net profit of approximately $116 and $119 per acre for the dusted and sprayed plots, and for each dollar spent for poisoning there was a return of about $5.

In one field which produced 1¼ bales per acre, the net profit was approximately $175 and $182 per acre for the dusted and sprayed plots, respectively, and for each dollar spent for poisoning there was a return of about $8.

Although experiments should be conducted in all cotton-growing areas to determine the merits of the "early-season control," we know from long experience that "early-season control" is not al-

ways necessary for the production of profitable crops of cotton. As previously stated, remarkable demonstrations of the value of cotton insect control could be found in most of the counties where the boll weevil occurred during 1949 and 1950. My attention has just been called to some notable records made in Madison Parish in the Delta section of northeastern Louisiana during 1950. The boll weevils were never more numerous in this parish than during 1950. Even in the presence of heavy boll weevil infestations farmers can, by following modern agricultural practices, including the judicious use of insecticides, produce remarkable yields of cotton as indicated by the following table:

Name	Pounds Seed Cotton Per 5 Acres	Pounds Lint Cotton Per Acre
1. E. C. Woodyear	19,180	1,496
2. Fulton Levy (on plantation of J. W. Carpenter)	17,615	1,374
3. Harry Willis (on plantation of J. W. Carpenter)	16,315	1,272
4. Derwood Wilhite	14,910	1,163
5. A. L. Harvey	13,975	1,090
6. Fate Barnes (on plantation of J. W. Carpenter)	12,187	950
7. Luther Previtt (on plantation of J. W. Carpenter)	11,840	923
8. Ashley Plantation	9,260	722
9. A. R. Weems	9,172	715
10. Mack Medlin	7,750	604

These ten cotton growers averaged 1,030 pounds of lint, or more than two bales of cotton per acre. The boll weevil was the principal insect that had to be controlled and it is my understanding that the insecticide formulations used in each case contained either benzene hexachloride, calcium arsenate, or toxaphene.

The research chemists and entomologists working together have made so much progress in developing new insecticides for cotton insect control that there has been a tendency to overlook progress that has been made in other lines. Although 1949 was a year when the boll weevil was unusually abundant, some farmers produced excellent crops without using insecticides. Near Sanford, Florida, one grower obtained 27 bales from 15 acres. By following practices that research workers had found were sound, he had one of the most profitable crops in the country in an area where the boll weevil was thought to have put cotton growing out of business thirty years ago. Perhaps the chief secret of his success was the use of modern farm equipment, especially a powerful tractor-drawn stalk cutter that cut the cotton stalks into small pieces in August and a plow that buried the stalks and surface debris deep in the soil. This farmer produced a crop of celery after his cotton stalks were cut and plowed under.

In the early days of research on the boll weevil it was proved that stalk destruction well before the occurrence of frost starved the weevils so they died during the winter. Studies on the pink bollworm showed early stalk destruction to be effective in controlling that pest also. The winter kill of weevils and pink bollworms is directly correlated with the date of stalk destruction; the earlier the stalks are destroyed, the higher will be the mortality. Early destruction of the cotton stalks has been a recommended cultural practice for boll weevil control for many years, but few farmers have made a real effort to follow it.

It was only when the pink bollworm became such a grave threat to cotton production and regulations requiring stalk cleanup were put into effect in the Lower Rio Grande Valley of Texas that the full value of that practice was convincingly shown. The first large scale demonstration of the efficacy of early fall destruction of cotton stalks by all farmers in a large area took place in 1945 in Cameron, Willacy, and Hidalgo counties in southern Texas. Quarantine regulations against the pink bollworm required that all cotton stalks be destroyed by August 31. Practically 100 percent of the stalks in the area were cut and plowed under by that date.

In the area where the cotton stalks had been destroyed by August 31, 1945, the average infestation during the last week of June 1946 was 14 percent punctured squares in contrast to 55 to 75 percent punctured squares in the counties of Central Texas where cotton stalks had not been destroyed early.

Farmers in the Lower Rio Grande Valley did not have to spend any money in 1946 for insecticides for boll weevil control although large quantities had been required in previous years. Cotton fields produced ¼ bale of cotton more per acre in 1946 than in 1945, at a value of $45. It is estimated that early stalk destruction in this area was equivalent to 4 or 6 applications of an insecticide.

This demonstration, combined with other data accumulated over a period of years, indicates that if cotton growers in all areas where the practice is feasible would, through community effort, each year cut and plow under all stalks

(Continued on Page 86)

CONFERENCE REPORT on Cotton Insect Research and Control, Dec. 4-6, 1950

RESEARCH and extension entomologists and associated technical workers from 12 cotton-growing States (Alabama, Arkansas, Georgia, Illinois, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas), Puerto Rico, the United States Department of Agriculture, and the National Cotton Council of America participated in a conference at the Gayoso Hotel, Memphis, Tennessee, December 4-6, 1950, to review and summarize their experiments and experiences in cotton insect control and to formulate a guiding statement for control recommendations in 1951. After a review of all available information, the report that follows was agreed upon by all the conferees.

Cultural methods as well as the use of insecticides for controlling cotton pests are considered in the report. The use of cultural control methods cannot be too strongly emphasized. It should be recognized that control of cotton insects by the use of insecticides is really supplemental to the adoption of good farm practices. These include such factors as early fall clean-up before frost, seed treatment, early planting, fertilization, use of proper cotton varieties, proper land use, and cultivation. Cultural measures are influenced by climate, soil conditions, fertility, topography, and geographical location.

In addition to recommendations for the use of certain insecticides for the control of cotton insects, the report presents information believed to be of value to industry in planning production programs and to aid State and Federal workers who cooperate with cotton growers in testing some of the insecticides that are still in an experimental stage. It contains some suggestions as to research needs in developing a more effective cotton insect control program. A general statement of plans by which the extension entomologists will aid in bringing the 1951 cotton insect control recommendations for each State to the attention of growers and all other interested groups is included. Control recommendations are presented in a general manner and are not specifically fitted to local needs. It is expected that each State, in preparing recommendations for cotton insect control for 1951, will adapt to its own conditions the information given in this summary.

Hazards and Precautions in the Use of Insecticides

The development of the newer synthetic organic insecticides has provided more effective means of controlling insects, but it has also intensified numerous problems, such as hazard to man, domestic animals, crops, and beneficial wild life. With few exceptions, all insecticides are poisonous to animals and man and because of this they should be used with appropriate precautions.

The factor of immediate toxicity of insecticides to the user, to livestock, to beneficial insects, and to plants is of great importance. In addition, there is the effect of chronic toxicity due to repeated exposures, of accumulations in soils, and of residues on treated plants and on adjacent crops caused by drift. Everyone concerned with insecticides and their use should be thoroughly familiar with these various hazards and should take proper precautions when formulating, packaging, labeling, and applying the materials.

• **Precautions for the User**—In considering the hazards to man, it is necessary to distinguish between the immediate hazards (acute toxicity) and the accumulative effects (chronic toxicity). Man can be poisoned by breathing most insecticides or absorbing them through the skin, as well as by swallowing them.

Most solvents used in preparing solutions or emulsions are poisonous, and some are inflammable. Research and experience to date indicate that new chlorinated organic insecticides are reasonably safe to man and the higher animals at strengths normally applied for cotton insect control. In concentrated form, some of the chlorinated hydrocarbon insecticides may cause acute poisoning if they contact the skin or if they are swallowed accidentally. Also, continued contact with or exposure to such materials may result in an injurious accumulation of the toxic ingredient in the body. Persons engaged in applying these insecticides should therefore avoid unnecessary exposure to them. Wearing a respirator with suitable filter pads is advisable. The hands should be washed thoroughly before food is handled. After a dusting or spraying operation is complete, and at least once a day when handling or applying insecticides, it is advisable to bathe and change clothes.

The phosphorus compounds, such as parathion and tetraethyl pyrophosphate, *are extremely poisonous materials and must be handled with great care.*

It is not practicable to set forth here all precautionary measures that should be taken if phosphorus compounds are used. Such information is available through the Bureau of Entomology and Plant Quarantine and basic manufacturers, and all users should be thoroughly familiar with precautions and see that they are followed.

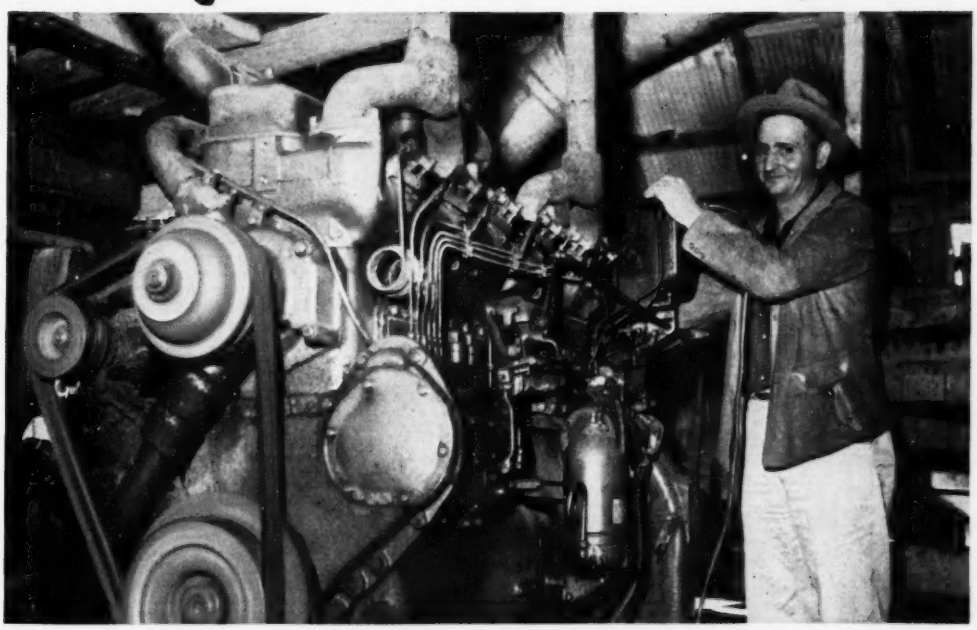
One of the more important precautions to observe is the avoidance of breathing wettable powders, dusts, sprays, or vapors. When handling or applying parathion, use a respirator that has been passed by the U. S. Department of Agriculture.

Loading and mixing should always be done in the open. Impervious gloves should be worn if it becomes necessary to handle the materials, but it is best to avoid any unnecessary contact with insecticide sprays as well as dusts. The concentrated emulsions and wettable powders are especially dangerous. As soon as possible after the use of phosphorus compounds, exposed personnel should bathe and change clothes.

It is advisable to have at hand in the field a change of clothing, soap and water, and a small supply of 1/100-gr. atropine tablets for emergency use, as recommended by com-

THIS REPORT, which was approved by the 76 entomologists and associated technical workers who participated in the Conference, incorporates more information on cotton insect control than can be found in any other single paper. It brings together the results of recent research and experience in insect control and is an invaluable source of information for all who will have a part in the 1951 control program.—ED.

Sample Sells Sample



Bert Sample uses his International UD-24 to power his 3-stand, 80-saw gin, four blowers, cleaners and other requirements, ginning an average four bales per hour.

Bert Sample, Pleasant Plains, Arkansas, picks his second International UD-24 for quick-starting, power and economy

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petent medical authorities. Quick action is essential in case any symptoms of poisoning appear. Persons directing control operations should assume full responsibility for enforcement of adequate precautions and should have had medical advice as to emergency atropine use.

Both spraying and dusting operations should be done under such conditions and in such a manner as to avoid excessive drift to adjacent fields where animals are pastured or where food crops are grown. No organic phosphate should be applied by aircraft or custom sprayer in such a manner that unprotected persons will be exposed to dust or spray. Care in preventing drift is also essential because certain varieties of plants and kinds of crops are injured by certain insecticides. Spillage of insecticides where they might contaminate water used by man or livestock should be avoided. Any excess dusts or sprays, even in small quantities, should be deeply buried.

All empty containers in which insecticides have been packaged should be burned or otherwise destroyed immediately after emptying. Insecticides should always be clearly identified by labels and stored in a place where they are inaccessible to irresponsible persons and to domestic animals.

Equipment used for applying weed killers should not be used for applying insecticides because of danger of crop injury.

• **Residues in Soils**—The effect of insecticides on germination, rate of growth, and flavor of crops may be influenced by type of insecticide, formulation used, soil type, kind of plant, and concentrations of residue in the soil. Information to date indicates that in the amounts and concentrations recommended for the control of cotton insects, no immediate hazard to crop is involved. Injury to several crops by higher rates of application of some insecticides on certain soil types has been demonstrated. Benzene hexachloride may cause off-flavor of peanuts and root crops. The possibility that the off-flavor may occur in peanuts grown in fields where cotton was previously treated with benzene hexachloride is being investigated.

• **Safeguarding Beneficial Forms of Life**—Insecticides destroy beneficial as well as injurious insects. Certain materials are also highly toxic to fish and other forms of aquatic life. It is especially important to use minimum amounts where there would be an unavoidable drift to ponds and streams. In disposing of excess spray or dust materials, or when cleaning dusting or spraying equipment, every precaution should be taken to avoid the pollution of streams and farm ponds stocked with fish.

Methods of Applying Insecticides

• **Dusts**—The new organic insecticides are used as toxicants in dust mixtures with carriers such as talcs, pyrophyllite, and clays, or in mixtures with other insecticides. Too much emphasis cannot be placed upon proper formulations.

Progress has been made in the formulation of good quality dusts for use on cotton. However, in some instances research workers have attributed erratic results and poor control to inferior dusting qualities of the mixtures. The use of mixtures with excellent dusting qualities is in the interest of insecticide conservation, essential in view of the present insecticide supply situation. More information is needed concerning insecticidal formulations to establish criteria for suitable organic dust mixtures.

Sulfur as a diluent gives dust mixtures certain undesirable physical properties. The supply of sulfur is short for 1951 and it should not be used as a diluent for other insecticides. However, in those areas where spider mites are usually a problem, 40 percent of a good grade of dusting sulfur or some other suitable miticide is desirable in the mixture.

• **Sprays**—Several organic insecticides applied in spray form were used widely during 1950. Results during the last three years have shown that concentrated sprays of organic insecticides applied with ground equipment and airplanes gave control of cotton insects equal to that obtained with dusts. Sprays have a wide range of usage in that they can be applied during most of the daylight hours, even under conditions of relatively strong winds (15 miles per hour). Boll weevil control has been obtained with as little as 1 gallon or as much as 15 gallons of spray per acre with the toxicant remaining constant at the recommended rate. Sprays have been successfully applied to cotton for control of boll weevils, bollworms, pink bollworms, thrips, cutworms, cotton fleahoppers, tarnished plant bugs, rapid plant bugs, cotton aphids, various pentatomids, garden webworms, and spider mites. Most of the new organic insecticides can be made into emulsifiable concentrates, which with the addition of water give emulsions suitable for application. Slight

foliage burning has been noted in some instances when the emulsifiable concentrate was poorly formulated, or when the emulsion was improperly applied, or poorly distributed.

Most oil solutions of insecticides which have been tested caused foliage injury. Tests of experimental oils indicate that the viscosity and volatility of the oil and its aromatic content are the main factors causing the undesirable foliage reaction.

Solvents with a relatively low boiling range and aromatic content which will dissolve the toxicant appear to be the most desirable for use in emulsifiable concentrates. Emulsifiers and solvents should be tested for toxicity to the cotton plant and their general suitability determined before they are used in formulations.

In general, the mass medium diameter of the spray droplets should range from 100 to 300 microns. Manufacturers' recommendations should be followed in regard to pressure for specific nozzle size to insure a proper spray pattern.

For treatment of seedling cotton in most areas it is suggested that with ground equipment one nozzle per row be used to apply the spray and, as the cotton increases in size, the number of nozzles per row be increased up to three to obtain full coverage. If nozzles are kept at least 10 inches from the plant, the danger of leaf burn is minimized.

For use in ground equipment, it is essential that spray concentrates be diluted immediately prior to use with not to exceed an equal volume of water, and the diluted emulsion then added to the required volume of water. During the spray operation some type of agitation is essential in order to insure a uniform emulsion.

As a safety measure, it is recommended that the spray boom on ground equipment be located behind the operator.

For airplane spray application, it is suggested that from 1 to 2 gallons of spray containing the recommended rate of toxicant be applied per acre. It is essential to use some method of flagging or marking of swaths for best results in airplane spraying.

For stability in storage and to prevent breakdown of the formulation when metal containers are used, the containers should be lined with some material that will not react with or cause deterioration of the concentrate. It is desirable that the insecticides be prepared in such a way that they may be combined with each other to form a satisfactory emulsion.

It is suggested that whenever possible the manufacturers prepare formulations in even multiples of the amounts of insecticide recommended per acre. The pounds per gallon of each insecticide in the concentrate should be shown on the label.

Insecticides

The experimental data and the results of field tests presented at the Conference showed that no particular insecticide gave results outstandingly superior to those of any other recommended insecticide or mixtures of materials when they were used according to the recommendations of the official entomologists and at the dosage, time, and frequency recommended. The most important factors in the effective use of insecticides for cotton insect control are the dosage, timing, frequency, and thoroughness of application.

• **Aldrin**—Aldrin received wide usage for cotton insect control during 1950. In most cases, it will control the boll weevil, thrips, the cotton fleahopper, the tarnished plant bug, the rapid plant bug, grasshoppers, and newly hatched cotton leafworms. It will not control the bollworm, the cotton aphid, or spider mites. For boll weevils, aldrin should be applied at the rate of 0.25 to 0.5 pound per acre. Aldrin is effective as a dust or as as pray.

Aldrin is toxic by skin absorption, by inhalation, and by ingestion. It is recommended for use on cotton only where persons applying it are fully aware of the hazards and will follow the precautions prescribed by the manufacturers. See Hazards and Precautions in the Use of Insecticides.

• **Benzene Hexachloride**—Benzene hexachloride will control the boll weevil, the cotton aphid, the tarnished plant bug, the rapid plant bug, the cotton leafworm, thrips, the southern green stink bug, the garden webworm, the fall armyworm, the cotton fleahopper, and grasshoppers. It will not control the bollworm, the pink bollworm, the salt-marsh caterpillar, and spider mites. For this reason, benzene hexachloride alone cannot be successfully employed for over-all cotton insect control. Benzene hexachloride also kills many beneficial insects.

In dusts, benzene hexachloride at approximately 0.3 pound of the gamma isomer per acre (example: 10 pounds of benzene hexachloride dust containing 3 percent of the gamma isomer) is the minimum rate which has consistently given satisfactory control of all cotton

(Continued on Page 68)

Interrelationship of INSECT CONTROL DEFOLIATION AND CULTURAL PRACTICES

By W. H. THARP

COTTON GROWERS in the United States will be faced with the problem of producing about sixteen million bales of cotton during 1951, after having limited production to less than ten million bales in 1950. Although some increased yields and expansion are possible for our best cotton lands, it is anticipated that the majority of this increase will be met through expansion to land not too well suited for most efficient

W. H. THARP

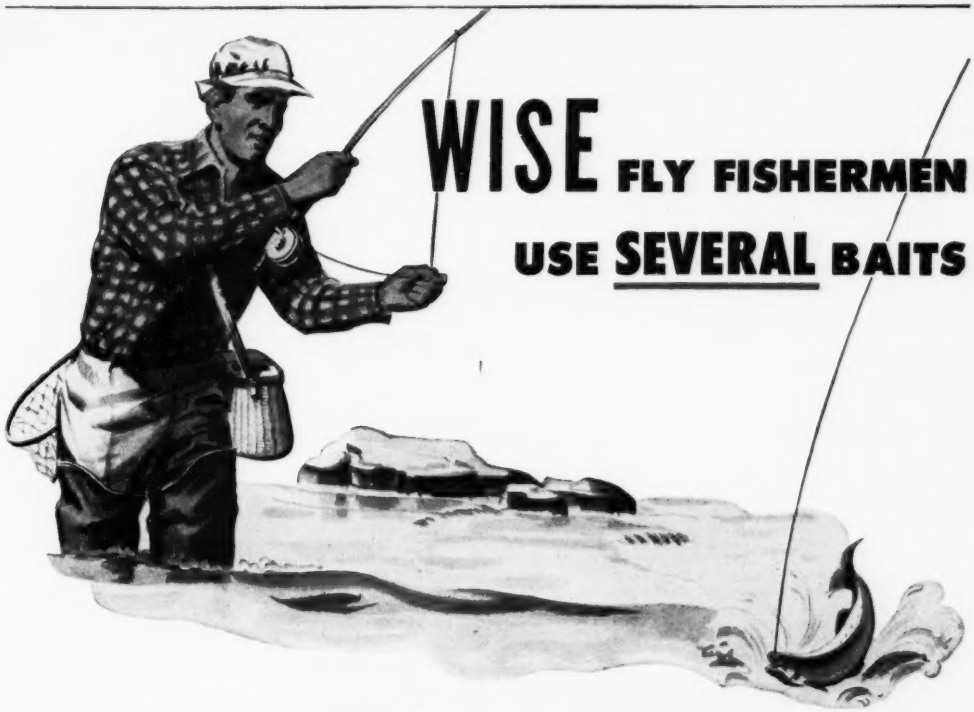
cotton culture. Much of this cotton may become badly out of adjustment with one or more phases of its growth environment and have a reduced ability to produce well in the event of severe disease attacks, insect infestations or unfavorable weather conditions. It is thus anticipated that many of our most difficult problems of cotton production may be intensified by this expansion. Also, it is quite evident that the problems arising in any one phase of production will most certainly be interrelated with those developing in other specialty fields.

The matter of time will be of utmost concern primarily because manpower and machinery may be all too limited. While we can hope to care for each cultural operation at the most advantageous time during the season, it must be anticipated

The author is with the Division of Cotton and Other Fiber Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

DEFOLIATION has a part in our effort this year to produce a 16-million-bale crop . . . it can mean higher acre yields and better quality lint and seed . . . and, as the author points out, it is a definite aid to the insect control program.—ED.

Photograph of a section of a well defoliated field of cotton.



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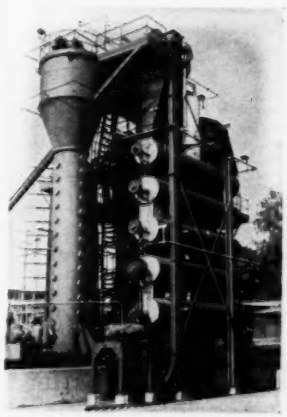

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that many acres will be planted too early and many others too late. In early plantings we are always faced with the probability that low temperatures, excessive moisture and seedling diseases may combine to reduce stands and necessitate replanting. Already there is a strain on the facilities offering vigorous seed of quality lines of cotton. Thus is due in part to an increased demand and in part to a condition that made much of the early seed produced in the Southeast this last year either worthless for planting or of questionable viability. The final result in 1951 may be many poor stands, with the plants getting off to a poor start and then becoming further weakened through competition with weeds and grasses.

Here the interrelationship between culture and insect control begins. Any insect that retards growth must be held in check so that the early-planted cotton will have a chance to pull through in the event of unfavorable cotton weather. On the other hand, it is inevitable that many acres will be planted later than desired. We must consider these late plantings as potential sources of a late maturing crop—one that will not get ahead of, and hence be subjected to, loss through attacks of weevils and other insects that damage the cotton crop late in the season.

The development of new organic insecticides, together with certain advances in methods of application, have made possible the use of insecticide combinations that are effective for control of all major cotton insects throughout the season. Of course this may be true in a practical sense only where control can be practiced on a large community basis. On the other hand, the developments in new materials and methods make early season insect control a practical possibility even on a single farm basis.

At this point it should be emphasized that, without exception, it is important to focus our attention on every means of making our crop early. In each of the major cotton areas there is some penalty for lateness in excess of any loss in yield. You are all well aware that in the Southeast the late crop is the one most subjected to loss from insect attack and the one most likely to suffer from late season weathering which will at times cause sufficient deterioration of fiber and seed to warrant eventual abandonment of some acres. It becomes of utmost importance to concentrate on the crop as it is initiating its first buds. The cotton insects that may knock off many of the first squares, or otherwise interfere with vigorous early-season development, must be controlled for earliest possible production. Otherwise, the plant will be forced to continue in a highly vegetative state. It will become rank and leafy before heavy fruiting starts and eventually it may become an invitation to the severest types of boll rots and boll weevil infestations

In considering how defoliation fits into the insect control picture, it should be realized that, although defoliation may be considered as a measure of cotton insect control at the end of the season, it is also a fact that any lack of weevil control will contribute to defoliation inefficiency. In fact any insect, plant disease, or physiological condition that prevents fruiting buds from developing into mature bolls will retard earliness and indirectly limit efficiency of the defoliation practice.

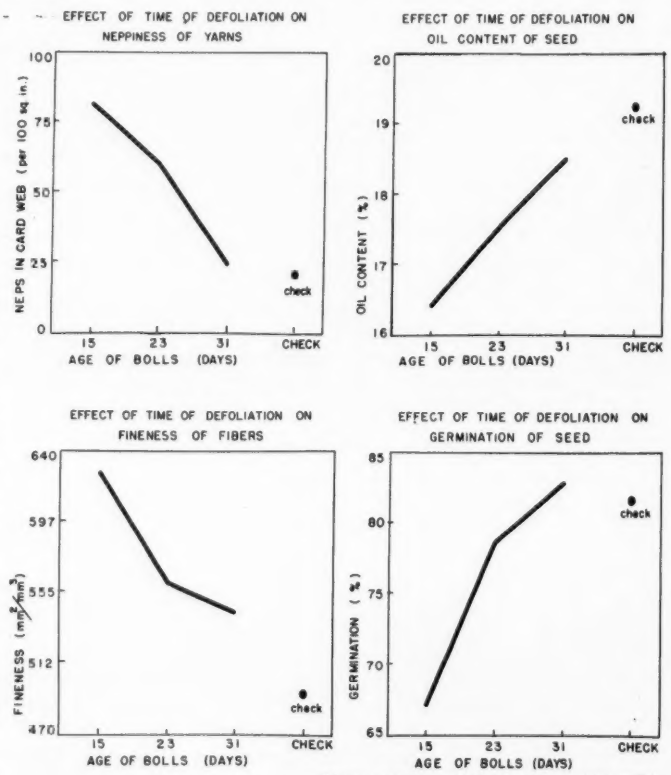
Defoliation of cotton, which involves abscission of deciduous leaves, is an entirely natural process but it is distinctly a function of biological senescence or physiological aging. In cotton, senescence has been found related directly to exact degree of reproductive maturity. We must be realistic concerning this dependency because anything that tends to keep the cotton plant in a partial or complete state of pure vegetative growth, as contrasted to setting and maturing a full load of bolls, will invariably lead to complete or partial failure with proper use of our present defoliants. Plants that have set no bolls will seldom defoliate and it matters little whether the plant is too young for boll set or one that has been growing vigorously all summer yet prevented from setting bolls by insect infestation. At the other extreme, a plant with its vegetative growth slowed down or nearly stopped, because its entire growth capacity is being utilized for boll maturation, should defoliate efficiently. In between these extremes we have all gradations of partial success with the applications of defoliants.

During 1950 a familiar sight to many was the plant with a few low bolls set early and the remaining top growth vigorous but entirely devoid of bolls. If defoliation was tried on such plants it undoubtedly removed only those leaves in the vicinity of the mature bolls. Such top growth is no different from the all too familiar second growth in the sense that both defy efficient defoliation.

On the other side of the defoliation-insect control interrelationship there is a distinct part that defoliation plays in insect control. The report from the 1949 conference on Cotton Insect Research and Control outlined these benefits in accurate detail. In brief: defoliation causes boll weevils to leave such fields, it reduces subsequent infestation, and it checks damage from late aphid and leaf worm infestations. Since it permits earlier harvesting and subsequent stalk disposal, it serves to lessen weevil carryover and assists in pink boll-worm control. Therefore, any failure to control the insects that could prevent timely and complete reproductive maturity of the cotton plant would be the cause of unsatisfactory defoliation and thus place a severe limit on the manner in which defoliation may be used as a measure of insect control.

In searching for efficiency of, and highest benefits from, the defoliation process

EFFECTS OF DEFOLIATION in relation to age of bolls. The data represent effects on the top crop (cotton that had not opened until at least 31 days following cut-out). Results presented are the average results obtained in Regional Defoliation Study No. 5, in 1949 from five locations: Sacaton, Ariz.; Marianna, Ark.; Stoneville, Miss.; Sikeston, Mo., and Chickasha, Okla. Reproduced by permission of the cooperators.



Division of Cotton and Other Fiber Crops, ARA, USDA.

it must be remembered that certain precautions are needed. Development and preservation of desirable seed and fiber properties must always be kept in mind. There is much evidence to demonstrate that, when defoliation is used to promote early harvesting and get ahead of fall wet spells, it contributes to saving quality; as it is measured in terms of grade as well as in terms of individual properties of seed and fiber. If, however, the operator applies defoliants too early, the grade of seed and fiber and the usefulness of the products can be considerably impaired.

Four charts are shown here as an illustration of this hazard. These represent the average results obtained at 5 locations[1] in the Regional Defoliation Experiment No. 5, as conducted in 1949. In each chart the effect shown is that of time of defoliant application on the seed and lint properties of the top crop. Here it is seen that when defoliants are applied 15 days after cut-out, or to bolls but 15 days old, the oil content and the viability of seed may be reduced significantly and spinning value of fiber, as evidenced by fineness and neppiness, may be seriously impaired. When defoliants are applied to bolls of 23 days maturity, there is less evidence of severe loss in quality. When bolls are 31 days old defoliation still has some adverse effect on oil content and fiber fineness but viability of seed and neppiness are uneffected. It should be emphasized that these are effects on the top crop—the lastest cotton. Bolls developed earlier will be less affected. The hazard is in direct proportion to the percentage of bolls of this age or younger at the time of defoliation. These four specific characters are illustrated here because they are the submerged evidence and, except where seed are sold on grade, the grower seldom receives a cut because of the impaired quality. Yield, length of fiber and strength, as well as appearance of the sample, may also be lowered by applications made too early. It is research evidence such as this, that has motivated the recommendation that defoliants should not be applied until the last bolls expected to make cotton are at least 25 days old. In certain areas where bolls mature slowly, it may be necessary to consider that 25 days of maturity is not sufficient.

Obviously, the decision relative to choice of an ideal time for application of defoliants to any single field of cotton involves many considerations. Seldom is the grower blessed with the condition where he has a heavy crop of fully mature bolls on a plant that is in physiologically active condition and yet fully senescent at the time he wants his leaves off. All too often he may have to choose a date that represents a compromise. At times he may be forced to sacrifice maturity of the top crop in order to save his more valuable bottom crop from rotting. When cotton is extremely late and still rather vegetative, the problem becomes serious and the grower has to make his own decision relative to the time and type of application.

In years such as 1950, where many have experienced difficulty with defoliation, it is wondered why better defoliants have not been developed. It may take some time and a lot of painstaking investigation of the abscission mechanism in the cotton plant before perfection may be expected. Improvements are being made. Even now there is a series of chemicals available that can produce acceptable results under a varying set of environmental conditions and over a considerable range of plant activity stages. Developments are rapid in the field of defoliation. Advantages are being better recognized and use is increasing rapidly. It is inevitable that there may be some lag between development of fact and adequate education regarding efficient use of such facts.

It is unreasonable, however, to expect that chemicals will accelerate a natural plant process such as abscission when desiccation or cold weather pose almost absolute limits to physiological activity. Rather drastic herbicidal action (and all defoliants are essentially herbicides when employed in high concentration) will give some relief when plants are in a hard-to-defoliate condition, but this practice often produces poor defoliation and it is very rough on yields and quality of products. The juvenile plant condition, right now, seems to be the greatest obstacle to defoliation efficiency. On the other hand, it is not impossible that better understanding, through research on the biochemical mechanisms involved, will eventually permit formulation of defoliants or a series of different types of compounds that will be capable of inducing or hastening physiological maturity as well as accelerating the abscission process.

[1] Reproduced through permission of cooperators. Data are from experiments conducted at Sacaton, Arizona; Marianna, Arkansas; Stoneville, Mississippi; Sikeston, Missouri and Chickasha, Oklahoma.

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20-40
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(Aldrin)

2½-5-0
(Aldrin and DDT)

2½-10-0
(Aldrin and DDT)

2½-5-40
(Aldrin, DDT and Sulphur)

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(Aldrin, DDT and Sulphur)

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Your best protection against the weevil and other insects which attack cotton is a reliable, dependable insecticide. Make your choice from the complete line of Black Leaf® Cotton Insecticides listed at left.

Produced at Montgomery, Alabama, and stocked in warehouses conveniently located throughout the cotton belt, these Black Leaf Dusts and Sprays are the result of years of experience in the manufacture of high-quality insecticides.

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Black Leaf Cotton Insecticides are packed for easy handling ...Dust Formulations in multiwall bags...and Spray Concentrates in 5, 30 and 50-gallon drums. Use Black Leaf Cotton Insecticides and follow application schedules recommended by your local authorities.

TOBACCO BY-PRODUCTS & CHEMICAL CORPORATION
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Robert H. Owens Is Named Roots-Connersville Head

Robert H. Owens has been elected president and general manager of Roots-Connersville Blower Corp., succeeding

ROBERT H. OWENS

John Avery, who died unexpectedly Jan. 13.

Mr. Owens, a graduate of Purdue University, came to Connersville in 1925 to

RALPH R. NEWQUIST

join the engineering staff of the P. H. & F. M. Roots Co., a predecessor of Roots-Connersville. Prior to joining Roots, Mr. Owens had a variety of industrial experience. He was actively connected with the development of the centrifugal line of blowers built by R-C and has many years of experience in building blowers.

In May of 1946, Mr. Owens was named vice-president in charge of engineering and manufacturing, and in July of 1948 he was elected to the board of directors of Roots-Connersville.

Ralph R. Newquist, who became vice-president in charge of sales for Roots-Connersville in May of 1946, has been elected executive vice-president. Before joining Roots-Connersville, he was manager of the Washington sales office for the Allis-Chalmers Manufacturing Co.

Roots-Connersville Blower Corp. is a subsidiary of the Dresser Industries, Inc., whose headquarters are in Dallas, Texas.

Flowers Resigns as Editor; Rosenkrans Takes Over Job

D. B. Rosenkrans, Jr., has been named Mississippi Extension Service editor to succeed Jack Flowers, who has resigned, effective March 1, to go with the International Press and Publications Division of the State Department in Washington, D. C.

Mr. Rosenkrans has served as assistant extension editor since June, 1948. He completed requirements for a BS degree in agronomy at Clemson Agricultural College, Clemson, S. C.

Area of Production Hearing In Washington April 2

There will be a public hearing in Washington April 2 on the Wage-Hour administrator's current definition of Area of Production. The hearing will begin at 10 a.m. and will be held in Conference Room B, of the Inter-Departmental Auditorium.

Peabody Is Headquarters for

National Ginners Meeting March 15-16 at Memphis

■ **Delegates will consider fire prevention, bale ties, wage-hour regulations, new ginning methods, fiber damage and government regulations at annual session.**

Final program details for the 1951 annual meeting of the National Cotton Ginners' Association in Memphis, Tenn., March 15 and 16 have been released by Horace Hayden, executive vice-president.

Business sessions will be held at the Peabody Hotel, which is headquarters for the meeting.

• **Fortenberry to Open Meeting**—President W. O. Fortenberry will make his annual address immediately after the meeting convenes at 10 a.m. March 15. Following the address, he will name a committee on nominations. At the end of each discussion of a particular subject during the two-day meeting, Mr. Fortenberry will name a committee to write a resolution as a guide for the association in regard to that subject.

• **Matthew M. Braidech to Talk on Fire Prevention**—Causes of cotton fires and their prevention will be the first topic to be considered by the delegates. This discussion will be given by Matthew M. Braidech, director of research, National Board of Fire Underwriters, New York, N. Y.

• **Bale Ties to Be Discussed by Dr. Johnson**—Dr. Burt Johnson, cotton technologist, National Cotton Council, Memphis, will talk on bale tie coating or new material for bale ties.

• **John H. Todd to Report on Wage-Hour Regulations**—The status of petitions to the wage-hour administrator will be reported on by John H. Todd, Washington representative for the National Cotton Compress and Cotton Warehouse Association and legislative counsel for the National Cotton Council.

• **Chas. A. Bennett to Discuss New Ginning Methods**—A report from USDA on new ginning methods will be given by Chas. A. Bennett, principal engineer, USDA Ginning Laboratory, Stoneville, Miss.

• **Fiber Damage to Be Subject of F. L. Gerdes**—F. L. Gerdes, in charge, Stoneville Laboratory, Research and Testing Division, Stoneville, will report to the ginner delegates on results in investigations of damage to cotton fiber in gin plants.

• **Officers to Be Elected on Second Day**—The second day's session will begin at 9:30 a.m. with the report of the nominating committee and election of officers. Other committees which will report at this session include those on fire prevention, bale ties, wage-hour regulations and new ginning machinery and methods.

Secretary - Treasurer Carl Trice Williams will also give his financial report at the final session.

• **Dunn to Discuss Government Regulations**—Only address on the second day will be made by Read P. Dunn, Jr., director of foreign trade, National Cotton Council, Washington, D. C., who will report on the status of price freezes, ceilings and other government regulations of the cotton industry.

• **Officers** — Officers of the National Cotton Ginners' Association are: W. O. Fortenberry, Lubbock, Texas, president; J. F. McLaurin, Bennettsville, S. C., first vice-president; Walter Craft, Carlsbad, N. M., second vice-president; A. G. Swint, Orchard Hill, Ga., third vice-president; Horace Hayden, Oklahoma City, Okla., executive vice-president; and Carl Trice Williams, Jackson, Tenn., secretary-treasurer.

Gandy Revisits Parish Where He Taught Vo-Ag

Dalton E. Gandy, Mississippi Valley field representative of the Educational Service, National Cottonseed Products Association, praised businessmen for their interest in balanced farming and livestock programs in a recent talk before the Lions Club at Arcadia, La.

DALTON E. GANDY

Calling attention to the progress that the parish has made since he was a vocational agriculture teacher there several years ago, Mr. Gandy pointed out that it was the result of cooperation between many business and agricultural groups.

The speaker described the activities which the cottonseed crushing industry carries on through the Educational Service to aid cotton and livestock producers.

Walter B. Moore Heads Southern Ag Editors

Agricultural editors elected Walter B. Moore of Dallas as chairman of their section of the Association of Southern Agricultural Workers at the recent annual convention in Memphis. Mr. Moore is assistant director of NCPA's Educational Service.

Edd Lemons, Oklahoma extension editor, was elected vice-chairman of the editors' section, and D. B. Rosenkrans, Mississippi extension editor, was named secretary.

WALTER B. MOORE

Mr. Moore and K. B. Roy, Alabama Experiment Station editor, are members of the board of directors of the agricultural workers group, which has approximately 1,000 members throughout the South and Southwest. P. O. Davis, Alabama extension director, is president; C. N. Shepardson, dean of the Texas A. & M. College School of Agriculture, is vice-president; and B. B. Jones, New Orleans extension agent, is secretary-treasurer.

1951-Crop Soybeans to Be Supported at $2.45

Secretary of Agriculture Charles F. Brannan announced last week a national average support price for 1951-crop soybeans of $2.45 a bushel. This support price is based on 90 percent of the Jan. 15 parity price, and compares with a national average support price of $2.06 per bushel on the 1950 crop, based on 80 percent of the Sept. 1, 1950, parity price.

"This increase in the support level for 1951-crop soybeans," Secretary Brannan said, "is being announced at this time, well in advance of the planting season, to encourage a national production nearly equal to the record production of last year. Since soybeans compete for acreage with corn, for which we are asking the maximum practicable production this year, it is felt that a harvested acreage approximating that of last year is about the highest level that can be reached with proper regard for long-range soil conservation practices."

The national production guides announced by Secretary Brannan on Feb. 2 called for a 1951 harvested soybean acreage of 13,000,000 acres as compared with 13,291,000 last year.

Price support will be effected through loans and purchase agreements available from time of harvest through Jan. 31, 1952, and obtainable from county PMA committees.

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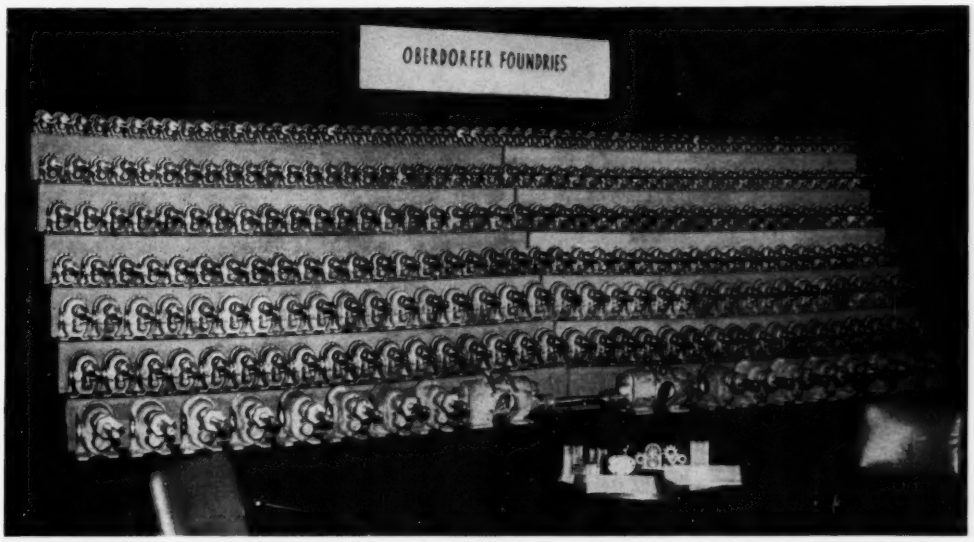
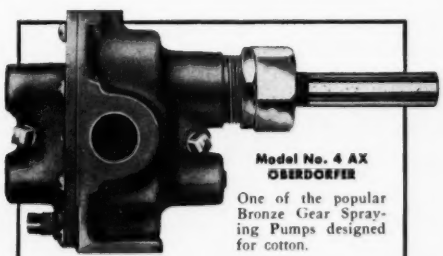
the standard throughout the cotton belt



It took 50 years of bronze gear pump manufacturing experience to produce this complete line of cotton spraying pumps



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One of the popular Bronze Gear Spraying Pumps designed for cotton.

A *complete* line with capacities from 90 to 9,000 gallons per hour at 100 lb. pressure.

You can't decide today to make bronze gear pumps and come up with a complete, satisfactory line tomorrow. It has taken us at Oberdorfer's over 50 years of large-scale production, and everlasting striving for improvement to produce the *complete*, proved-in-service line of cotton spraying pumps you see above. No other make can match its complete range of sizes or offer a comparable record of years of satisfactory service. Specify Oberdorfer Bronze Gear Pumps for all cotton spraying equipment — as most leading spray machine manufacturers have already done — and be sure of pump satisfaction. Agricultural Pump Division, Oberdorfer Foundries, Inc., Syracuse 1, N. Y.

OBERDORFER BRONZE SPRAYING PUMPS

From our Washington Bureau

By FRED BAILEY
and DON LERCH
Washington Representatives
The Cotton Gin and Oil Mill Press


BAILEY


LERCH

• **Squabbling Deters Defense Program** —Non-military phases of the defense program are not going well. That now is admitted by most of the defense agency heads attempting to get their program back on schedule.

Differences of opinion were to be expected, but not the bickering, wrangling, partisan politics and stalling by those willing to cooperate only on their own terms. Mobilization Director Charles Wilson is spending more of his time trying to settle internal rows than in building an economic control program.

Wilson, former head of General Electric, is becoming impatient and a bit disgusted with those who refuse to cooperate. He was supposed to have had full authority over all agencies directly involved in the economic defense program, but he is finding that many of them are going over his head directly to the President.

Heads of old-time government departments don't like being ordered around by Wilson. They insist on "having a look" at proposed orders involving their normal field of operation. Then they procrastinate and raise objection. The new control agencies have not synchronized their efforts and they often pull in opposite directions.

There is, as yet, no established policy for stabilizing the national economy. Wage and price determinations still are up in the air. Tax policies are a big question mark. Allocations and priorities as between the various segments of the economy are a matter of hot dispute.

• **DiSalle Blames Farmers** — Workable inflation controls still are not in sight. All the top agency heads admit privately, and some of them publicly, that stabilization still is months away. Each, however, blames someone else for the delay.

Price Stabilizer DiSalle points an accusing finger at farmers and says "there is the darky in the woodpile." He encourages labor to ask for higher wages so long as there is a possibility that food costs may go up farther. He is champing at the bit, anxious to dash off a whole series of ceilings.

Economic Stabilizer Johnston wants to go slow, give production a chance to ease price pressures. He argues that America's production potential is so great that, if encouraged, it can meet both military and civilian demand. He thinks a few controls over critical materials would work better than putting the whole economy in a straitjacket.

Wage Stabilization Director Ching wore his patience out trying to persuade labor to keep its wage demands within reason. He suggested a general wage increase equal to the rise in living costs since start of the war in Korea, plus an escalator provision for wage increases if costs go up. Labor rejected a 10 percent increase, demanded 15 percent and walked out when its demand was rejected.

• **Economic Control Machine Falters**—Jealousies, not only between control officials, but also between economic groups, are threatening to derail the entire stabilization program. Administration efforts to staff the control agencies with "loyal Democrats" hasn't helped matters any.

Labor leaders want their hands on the wheel, so they can pull the other way if they don't like the direction in which Wilson is driving. Agriculture, naturally enough, says that if labor is going to sit in the driver's seat with Wilson, we want someone at the wheel too.

Under those circumstances it would be a miracle if the economic control machine doesn't follow a zig-zag course, and a wonder if it doesn't wind up in the ditch. It is the natural result of trying to please everybody all the time.

The greatest danger is that control officials may already have lost their chance of public support and cooperation, without which no control program can succeed. It will, at best, take time and statesmanship to regain that confidence.

• **Farm Groups Want Representation**—Farm leaders, who for a time were inclined to sit back and wait, now are insisting that agriculture be adequately represented at the policy level in the economic control set-up. They are alarmed that OPA's mistake of placing college professors and Brooklyn lawyers in charge of farm policy making may be repeated by OPS.

Leaders of the four major farm organizations—Grange, Farm Bureau, Farmers Union and Co-op Council—have met several times in off-the-record sessions with Wilson and Johnston. They have reached tentative agreement on agricultural representation in the control agencies.

As now planned, each of the farm groups would name a representative to sit on a farm advisory committee to the Defense Mobilization Board. They would nominate a fifth man to be selected by Wilson to serve as chairman.

In addition, an experienced farm man would be named to serve at the policy making level on the Stabilization staff of Johnston, the Defense Production staff of Gen. Harrison and the price staff of DiSalle. J. B. Hutson, former Undersecretary of Agriculture, already is on DiSalle's staff.

The farm groups nominated Jesse Tapp, an official of the Bank of America but formerly in USDA, and Carl Farrington, also a former top USDA official, for Johnston's staff. Johnston is to choose the man. For Harrison's staff they suggested either C. N. Silcox of the Grange League Federation or Arthur Barrows, former Sears & Roebuck president.

• **Farm Pricing Battle**—The battle over farm pricing will come to a climax when Congress takes up renewal of the Defense Production Act in a few weeks. The Act, which prohibits ceilings below parity or the highest price between May 24 and June 24, 1950, is due to expire June 30.

DiSalle is continuing to plug for a rollback of ceilings to below parity. The proposal at one time was reported to have White House backing, but there are indications now that the President will not push for it. Wilson and Johnston are not keen for it and Brannan is opposed.

The way things stand now a proposal to permit below parity ceilings would stand little chance in Congress. There is, however, some talk of "flexible" ceilings —a change in the law to permit ceilings anywhere from 90 to 110 percent of parity, but averaging at least 100 percent of parity.

Origin of that proposal is credited to Sen. Clinton Anderson. He thinks flexible ceilings could be used to help in guiding production, in shifting acreage from non-essential to essential crops where needed. It would, he says, avoid rigid ceilings which might tend to freeze production patterns. Brannan says he would oppose it and the farm organizations are cool to the idea.

• **Who's Running USDA?** — All is not well in the U.S. Department of Agriculture. Sharp clashes over personalities, programs and policies are upsetting things. Reports are again current that Secretary Brannan may soon take another federal post.

Farm visitors to the Department get the impression that Undersecretary Clarence McCormack is pretty much running the show. Department officials say he is "crowding" Brannan and may, before long, replace him.

If McCormack gets full powers you can

Haughton Publishing Co. Promotions Announced

At a meeting on Feb. 19 of the board of directors of Haughton Publishing Company, publishers of The Cotton Gin and Oil Mill Press, Richard Haughton, formerly president of the parent company and managing editor of this publication, was named chairman of the board. His son, Dick Haughton, Jr., formerly executive vice-president, was named president; George H. Traylor, formerly vice-president, was named executive vice-president; and Ivan J. Campbell, also a vice-president, and formerly associate editor of The Cotton Gin and Oil Mill Press, was named editor. B. P. Ridgway is vice-president and general superintendent of the company's printing plant.

Richard Haughton will remain active in the operation of the business. Dick Haughton, Jr., continues as advertising manager of this publication and Mr. Traylor as secretary-treasurer of the parent company.

expect some important changes in USDA personnel. Among those likely to go are PMA Administrator Ralph Trigg, and his top assistant, Frank Wooley. Trigg is a close friend of Sen. Anderson, who still is a power in farm affairs.

Brannan, late last summer, assigned to Trigg full powers to develop and administer defense programs assigned to the Department by the President. McCormack has usurped most of Trigg's authority. Minor officials down the line now are thoroughly confused as to who is the boss.

• **USDA Reorganization Jitters**—On top of all that, the Department now has an advanced case of reorganization jitters. It was McCormack who master-minded the shakeup which gave PMA top authority over both soil conservation and defense activities of the Department.

McCormack, rather than Trigg, now controls PMA operations at the State and county levels. He can direct defense activities of the Department through an elaborate national, state and county set-up of Agricultural Mobilization committees.

The National Agricultural Mobilization Committee consists of the heads of 13 Department agencies and bureaus, with the Secretary as chairman. State committees consist of PMA committee members, plus heads of the various Department agencies operating in the state, with the PMA chief serving as chairman.

County committees consist of all federal farm agency heads, with the PMA committee chairman also chairman of the Mobilization Committee. This gives the Department "straight line authority" from Washington to every county in the country.

The new soil conservation set-up likewise is built around PMA, at the national, state and county levels. McCormack's reorganization order requires that PMA and the Soil Conservation Service "consolidate" their offices in states and counties. At all levels the PMA chairman is to be the boss of conservation.

Only PMA seems to be happy over the new set-up. Farm organizations are protesting the "mixing of politics and soil conservation," and SCS feels that it has been assigned a relatively minor role. Extension Service apparently has been left pretty well out in the cold.

CCC to Purchase 1951-Crop Long Staple Cottonseed

Secretary of Agriculture Charles F. Brannan last week announced that the Commodity Credit Corporation will develop a program to purchase up to 5,000 tons of registered and certified cottonseed from the 1951-crop of Amsak and Pima 32 varieties of American-Egyptian cotton.

This program is being undertaken in accordance with a request by the Munitions Board to assure the production of sufficient extra long-staple cotton in an emergency to fill military and essential civilian requirements.

Commenting on the purchase program, Secretary Brannan said, "We are making this announcement at this time so that producers can make the necessary arrangements to produce registered and certified Amsak and Pima 32 cottonseed in 1951. The program will assure producers that they will be able to dispose of their registered and certified seed and will encourage them to incur the necessary expense in meeting the registration and certification requirements.

"Any seed purchased and not used in 1952 will be held for future use. Although all the details have not yet been worked out, it is probable that the program will be similar to the one in effect this year, except that only registered or certified seed will be purchased. It is expected that the purchase price will compensate growers adequately for the extra work and expense incurred in producing the desired seed. Current information indicates that sufficient foundation and registered seed is available for planting in 1951 to produce the quantity desired in 1952."

Crash Kills E. P. Pillsbury And D. L. Andrews

Edmund P. Pillsbury, 37, vice-president of Pillsbury Mills, Minneapolis, Minn., soybean oil mill operator, was killed with two other men when their small plane crashed at Paxton, Neb., Feb. 22 during a sleet storm. Mr. Pillsbury was the son of John S. Pillsbury, board chairman of the company.

Another of the victims was Dexter L. Andrews, 38, Wayzata, Minn., brother of Sewall D. Andrews, Jr., vice-president and director of sales of General Mills, Chemical Division, another soybean oil mill operator with headquarters at Minneapolis.

Council Urges Farmers To Treat Cottonseed

Warning that nearly all untreated cottonseed are affected with fungi which will attack the seedlings and kill a majority of the plants, the National Cotton Council is urging farmers to treat their seed with fungicides prior to planting.

Because of a seed scarcity this year, the Council explained, a great many growers are using home-grown seed instead of making purchases from dealers. If such seed are not treated properly they are susceptible to attacks from anthracnose and other harmful fungi.

Chemical treatment of cottonseed is one of the first necessary steps in the program to obtain high yields of cotton, the Council emphasized. With the nation needing every bit of the fiber farmers can produce, the organization insisted, growers cannot afford to gamble in their operations.

Detailed recommendations for cottonseed treatment—compiled at a recent meeting in Memphis of extension and research pathologists, fungicide manufacturers and Cotton Council representatives—have been distributed by the federal Extension Service. The circular lists rates of application, materials and where to obtain them, and manufacturers of seed-treating equipment.

These recommendations point out that a thorough job of seed protection, using one of the approved dust or slurry treatments, will: (1) help prevent seed decay and damping off; (2) improve emergence, resulting in better stands of plants; (3) save labor and expense of replanting, in many cases; (4) make scarce, expensive seed go farther by making it possible to reduce the seeding rate; (5) permit easier planting; and (6) increase average yields per acre.

Farmers may get their seed treated commercially or they can do the job on the farm. For information on home treatment of cottonseed, producers should consult their county agent, vocational agriculture instructor or other local authority.

NCPA, Oil Mill Cooperate On Michigan Exhibit

An educational exhibit of cottonseed products is being used in the Department of Animal Husbandry at Michigan State College as a result of the cooperation of the Producers Cotton Oil Company, Fresno, Calif., and the National Cottonseed Products Association's Educational Service.

The California firm supplied one of the exhibits, which it prepared for schools, to the Michigan college at the request of the Educational Service. Professor J. A. Hoefer of the Michigan Animal Husbandry Department writes that the exhibit will be most useful in teaching.

George F. Thomas Heads Prater Pulverizer Co.

George F. Thomas was elected president of Prater Pulverizer Co., Chicago, Ill., at a recent meeting of the board of directors. He will also continue in his former capacity of general manager.

Mr. Thomas, who has been with the firm for 20 years, succeeds the late Ralph Prater as head of the company.

Ford M. Ferguson Is Named Glidden Vice-President

Ford M. Ferguson has been named vice-president of the Glidden Company, Cleveland, Ohio, oil mill operator, in charge of all of the company's trading operations, Dwight P. Joyce, Glidden president, has announced.

Mr. Ferguson, who has been prominent

FORD M. FERGUSON

in the commodity trading industry for many years, joined the Glidden Company's Soya Products Division early in 1948 as executive assistant to Ralph G. Golseth, vice-president in charge of the division.

The new vice-president began his career in the industry with Cargill, Inc., in 1934 and rose to the position of assistant vice-president with that firm. He will continue to make his headquarters in Chicago.

Beef Cattle Feeding in South to Be Studied

Results of a beef cattle feeding demonstration started last October with Mississippi steers fed locally-produced feeds will be studied by a group of livestock authorities at the T. Coleman Potts farm near Crenshaw, Miss., March 7.

The Mississippi Extension Service, Crenshaw Oil Co. and Wilson & Co. are sponsors of the program, which will begin at 1 p.m. Among those who will discuss beef cattle feeding in the South will be Justin H. Doak, executive secretary, Mississippi Cattlemen's Association; E. E. Grissom, associate extension animal husbandman; H. H. Leveck, head, Animal Hubandry Department, Mississippi State College; J. A. Speights, Panola County extension agent; Joe J. King, Jr., planter and cattleman; Jim Draper, editor, Livestock Weekly; Ray E. Drenner, livestock buyer for Wilson & Co.; Bruce Harding, livestock market reporter for USDA; Paul Newell, Mississippi extension animal husbandman; Hal Crenshaw, planter and cattleman; and Mr. Potts.

"Feeding steers in the South the Corn Belt way, where there is an ample supply of grain, is proving profitable and is becoming more popular each year," Mr. Potts said.

51 More Texas Counties Are in Bollworm Area

Fifty-one additional Texas counties have been officially designated as pink bollworm infested areas by Commissioner of Agriculture John C. White, who has promulgated planting and field cleanup regulations for those areas.

September 25 is the date by which all cotton stalks must be plowed out in Aransas, Brooks, Duval, Jim Hogg, Jim Wells, Kenedy, Kleberg, Nueces, San Patricio, Webb, Zapata, the southern half of Refugio County and that portion of Starr County north of U. S. highway 83. Planting cannot begin in this territory until after Feb. 1, 1952.

A host-free period from Oct. 15 of each year to Feb. 1 of the next year is required for fields in Atascosa, Austin, Bee, Brazoria, Calhoun, Chambers, Colorado, Comal, De Witt, Dimmit, Fayette, Fort Bend, Frio, Goliad, Gonzales, Jackson, Jefferson, Karnes, La Salle, Lavaca, Liberty, Live Oak, Matagorda, McMullen, Medina, Orange, Uvalde, Victoria, Wharton, Wilson and Zavala Counties and the northern half of Refugio County.

Cotton may be planted in Maverick, Kinney and Val Verde Counties only between Feb. 15 and April 20, and all cotton plants must be destroyed by midnight Sept. 15.

A mandatory planting period from April 16 through May 25 has been established for Presidio County. No cleanup deadline has been set for this county, but growers were asked by Commissioner White to plant fast maturing varieties of cotton, irrigate to produce the crop quickly and harvest it expeditiously to control the pink bollworm.

Bastrop, Lee and Travis Counties have been given Oct. 25 as a deadline for plowing-under cotton stalks. Planting cannot begin in that area before Feb. 1.

Shooting Begins on Special Air Force-Cotton Film

A former Texas Panhandle farm boy who helped grow cotton is the star of a special film, entitled "King Cotton Keeps 'Em Flying," which is being produced at Houston, Texas, by the National Cotton Council through the cooperation of the Air Force Training Command.

Second Lieutenant Reuben A. Sullivan of Littlefield, Texas, is the central character in the film, which will take him back through his days of training as a navigator and show how dependent he was along the way on cotton. Shooting of the film began at Ellington Air Force Base near Houston Feb. 26. Other "locations" will be the George Chance farm at Bryan, Texas; Shepherd Air Force Base, Wichita Falls, Texas; and Nellis Air Force Base, Las Vegas, Nev.

Darkling Beetles Infest Rio Grande Valley Area

Reports from the Lower Rio Grande Valley indicate that a heavy infestation of darkling beetles was found in the Mercedes area early this week.

The beetles are not only a serious threat to spring tomatoes and other vegetables growing in the Valley but will also damage the cotton stand as the plants come up if they are not brought under control. Valley entomologists are recommending chlordane dust as the best method of controlling the darkling beetles.

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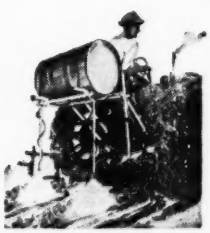

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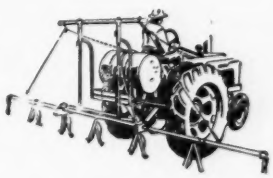
- ★ New Bigger Enparco Pump
- ★ Chrome Plated Gears
- ★ Intake 100 Mesh Strainer Screen
- ★ Flo-Control Manifold at Driver's Seat
- ★ Pen-E-Cone Nozzles
- ★ Boiling Action Cone Spray

Model 33

Cultivator Model 2, 4,or 6-row application with one, two, or three nozzles per row. Mounts on any tractor. Complete height and nozzle adjustment. Boom-within-a-boom construction. Light, easy to handle.

Model 27

For larger acreage 6, 8, or 10-row application. Either tractor or trailer mounted. Complete height and nozzle adjustment. Boom-within-a-boom construction. Crash-proof boom hinges. Light, easy to mount and adjust.



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Lipscomb, Council To Receive Medals

■ Awards by Freedoms Foundation to be presented for "grassroots" program of public relations for American agriculture.

Two Honor Medals "for outstanding achievement in bringing about a better understanding of the American way of life," will be presented to the National Cotton Council in recognition of its grassroots program of public relations for American agriculture.

The unusual announcement of two citations to one organization was made last week by Freedoms Foundation, a non-profit, non-sectarian corporation chartered for the specific purpose of making annual awards to Americans who make "outstanding contributions to a better understanding of freedom by the things which they write, do or say."

One honor medal will be awarded the Cotton Council in the "Community Programs" classification. This citation is for the organization's grassroots program.

A second medal will be presented to Ed Lipscomb, the Council's director of public relations, in the "Public Addresses" classification. The winning address, "This Is World War III," was delivered at the Southern Farm Bureau Training School in Oklahoma City last July. It outlined the objectives of the public relations program and detailed methods for carrying it out on a national scale.

"Grassroots Public Relations for Agriculture," of which Mr. Lipscomb is the author, is the handbook for the program which was instituted in Jan. 1950 by Council delegates at their annual meeting. The group, in a resolution, instructed the Council's office of public relations to cooperate with farm organizations and others in an effort "to strengthen public relations activities between agriculture and the public at large."

The book points out that the farmer is in a position to render yeoman service to the nation by taking active leadership in the fight to halt the trend to statism, and lays out the plans through which such leadership can be made effective.

During 1950 the handbook was put into active use by community, county, state and national farm leaders. In 31 states the Farm Bureau has distributed nearly 6000 copies to its officials and committee chairmen. The National Council of Farmer Cooperatives and 63 of its member cooperatives in 34 states are making active use of the book, as are local affiliates of the National Grange.

Numerous non-farm groups engaged in the struggle for maintenance of the American system against excessive government encroachment are utilizing the publication. These include the American Medical Association, 19 state medical associations, American Trade Association Executives, National Association of Railroads, Textile Bag Manufacturers Association, colleges and universities, and executives of large corporations.

In California the handbook is serving as the basis for organized statewide cooperative activity between farm and business groups.

In furtherance of the grassroots program, Mr. Lipscomb has addressed agricultural and allied organizations across the United States.

Plaques containing the Freedoms Foundation citations will be presented to the Council and to Mr. Lipscomb early in March by officials of the award organization.

Southern Regional Lab on Farm and Home Hour

Research conducted by the Southern Regional Research Laboratory to improve the utilization of southern farm crops will be discussed on the National Farm and Home Hour March 17, Dr. C. H. Fisher, director of the Laboratory, has revealed.

The broadcast, comprising eight minutes of the regular U.S. Department of Agriculture program sponsored by the Allis-Chalmers Company, will be at noon, Central Standard Time, over stations on the NBC network.

Andrew F. Freeman, who heads the project on improved peanut butter, and Dr. J. David Reid, who has supervised development of a soluble cotton yarn, will participate. Dr. Fisher will review some of the Laboratory's research on sesame, and on vegetables. Gordon Loudon, radio editor of the Extension Service in Baton Rouge, La., will announce the program, which will be transcribed in New Orleans.

State Guides

(Continued from Page 26)

when six to eight sucking insects per 100 are found in sweepings of a bug net (15-inch diameter) over the tops of the plants, made at several different points in the field.

Endeavor to apply insecticides when weather conditions are favorable. Tall, rank cotton may require heavier applications than are recommended.

Injurious Cotton Insects of Arizona And Controls Based on Research Conducted by the Bureau of Entomology and Plant Quarantine, Division of Cotton Insects

Beet Armyworm—A chewing insect—The beet armyworm may be the first insect to harm your cotton. It feeds on the cotton plant when it is in the seedling stage and in some instances may destroy the crop. It is not injurious every year, as parasites usually keep it under control. Some seasons it may injure squares late in the season. A dust mixture of 5-percent DDT and 75-percent 325 mesh conditioned sulphur will give good control when applied at the rate of 15 pounds per acre. If a spray is used, be certain to apply ¾ of a pound of DDT per acre. One pound of toxaphene and sulphur per acre may be an alternate material to use.

Darkling Beetle — Chewing insect — This is a minor pest; however, some seasons it may be very injurious, especially following alfalfa or in sandy soils. Control for this insect is poison baits or irrigation for long periods after sprouting time. Ten percent DDT and 75-percent 325 mesh conditioned dusting sulphur mixture applied at the rate of 15 pounds per acre by ground machinery gives good control. An alternate material may be an apple peel bait applied at the rate of 10 pounds per acre between the rows.

Lygus Bugs, Stink Bugs, Superb Plant Bug and Cotton Flea Hoppers — These are the most important sucking insects of cotton. They feed on squares or bolls of the cotton plant. The stink bugs cause more injury to cotton bolls and stain the lint. A 5-percent DDT and a high percent 325 mesh conditioned sulphur will control all these insects, except the stink bug, at the rate of 20 pounds per acre per application. Generally speaking, 10-percent DDT and a high percentage of sulphur is better for control of the cotton bollworm. Ten percent DDT and a high percentage of 325 mesh conditioned dusting sulphur applied at the rate of 15 pounds per acre may be cheaper and may give better control of the sucking and chewing insects. Research work also shows that 20 percent toxaphene and at least 40-percent 325 mesh conditioned sulphur is effective when applied at the rate of 15 pounds per acre per application. Sprays are equally as effective as dust. Be certain the same amount of technical material is used per acre. Do not use more than 4 gallons of material per application. Extremely rank cotton may require a higher gallonage per acre.

A 5-percent DDT, 2-percent gamma isomer benzene hexachloride and 50-percent 325 mesh conditioned sulphur will give best control of *stink bugs* when applied at the rate of 15 pounds per acre per application. If a spray is used, be certain to apply not less than four-tenths of a pound of gamma isomer benzene hexachloride per acre. An alternate dust may be 5-percent DDT, 15-percent toxaphene and 40-percent 325 mesh sulphur applied at the rate of 15 pounds per acre. If liquids are used, an alternate may be 2 pounds toxaphene, 1 pound DDT emulsion in 4 gallons of water per acre.

Thrips—If thrips cause severe curling of leaves on small plants, it is advisable to control with 5-percent DDT or 10-percent toxaphene and sulphur dust at the rate of 10 pounds per acre. Best results are secured with ground equipment.

Aphids or Cotton Lice—Sucking insect—Aphids sometimes cause serious injury to cotton in all stages of growth. The worst injury is caused by their presence on plants when cotton bolls are open. The "honey-dew" that they excrete injures the quality of the lint. Benzene hexachloride at the rate of one-half pound of the gamma isomer per acre gives a "knockout" of the aphids. One-percent parathion dust applied at 15 pounds per acre is also effective. *Follow directions when using.*

Cotton Bollworm — Chewing insect — The cotton bollworm feeds on both squares and bolls of the cotton plant. The bollworm must be controlled when it first appears. A 10-percent DDT and 60-percent 325 mesh conditioned sulphur

should be applied at the rate of 15 pounds per acre per application.

Cotton Leaf Perforator — A chewing insect—This insect causes the greatest injury to stub cotton; however, it may become injurious to planted cotton. Due to its habits of feeding only short periods, it is difficult to control. A 5-percent DDT and a 325 mesh conditioned sulphur will give good results when applied at 15 pounds per acre.

Red Spiders or Mites — Common red spiders or mites may appear in some fields in great numbers. If such an infestation does develop, an application of 325 mesh conditioned sulphur should be used at the rate of 20 to 25 pounds per acre. One application should give good control. There are some spider mites that are resistant to sulphur and recommendations for their control will come out in the weekly cotton insect report. In some areas of the State a 1-percent parathion, 5-percent DDT and sulphur dust looks good.

Salt Marsh Caterpillar — The salt marsh caterpillar, also known as the woolly worm, may cause some injury to cotton. All stages of this worm may be controlled with a dust mixture of 5-percent DDT, 15-percent toxaphene, and 40-percent 325 mesh conditioned sulphur. Apply at the rate of 15 pounds per acre per application. Toxaphene emulsion applied at the rate of three pounds of toxaphene per acre has also looked very effective for control of this insect.

Suggestions on Insecticides And When to Apply

Experimental work indicates a dust mixture of 5-percent DDT, 2-percent gamma isomer benzene hexachloride and 50-percent 325 mesh conditioned sulphur to be the best materials for control of stink bugs. This material should be applied at approximately 15 pounds per acre per application. The above material will also kill aphids if they are present. *In fact, this dust mixture will control all of the insects that infest the cotton fields except the Salt Marsh Caterpillar.* For alternate materials see the paragraph on *Lygus* control.

It is suggested by research workers, by the Extension Service and by crop dusters that a better job can be done if the farmer will furnish good flagmen. Also have a prearranged set of signals for both flagmen and pilot to use in case weather conditions necessitate a change in dusting. Good dusting companies know best poundage and best conditions for applying materials.

If Salt Marsh Caterpillars should appear in August, it is advisable that you control them with the recommended insecticides at once.

REMEMBER: *See your County Agricultural Agent if in doubt.*

Control of Insects in —

• Arkansas

Section 1

Arkansas farmers demonstrated during the heavy outbreaks of 1949 and 1950 that the boll weevil can be controlled by applying insecticides at the RIGHT TIME and the RIGHT PLACE. They used a variety of effective insecticides.

The prospects for an outbreak in 1951 depend on the weather. A record number of weevils went into hibernation last fall but severe winter weather undoubtedly killed many of them. A mild, dry winter favors high survival of hibernating weevils. A wet summer favors survival of immature stages of weevils developing in squares.

Correct timing and placing of applications require:

1. Ability to recognize punctured squares.
2. Ability to recognize stages of the boll weevil (weevil, egg, grub, and pupa).
3. Knowledge of habits of the boll weevil.
4. Knowledge of duration of the life cycle.

Development of Weevil

The boll weevil is a grayish-brown snout beetle about ¾ inch long. It feeds on squares and small bolls. Insecticides are aimed at killing the adult weevil, since it is the only stage not passed inside a square or ball.

The egg is 1/30 inch long, oval, and pearly white in color. It is laid by the weevil in a square or small boll.

A white, legless grub hatches from an egg. It develops entirely within a square or boll, destroying the contents. The full-grown grub changes to a white, delicate pupa or resting stage that resembles the adult in form.

The period in the square (egg, grub, pupa) is about 16 days in favorable summer weather. After an adult weevil emerges, it does not lay eggs or migrate to any great extent for seven or eight days. From generation to generation takes about 25 days during summer weather, and longer in cool weather. Boll weevils like warm, moist weather. Hot, dry weather kills the immature stages in the squares and may prevent an outbreak as it did in 1947.

Types of Punctures

Correct timing and placing of dust depends on scouting. Among other things, this requires ability to recognize the two types of boll weevil punctures. A FEEDING PUNCTURE is a small open hole on a square or boll, usually near the tip. Many such punctures are often found in a single square. Bright yellow castings scattered about indicate feeding. An EGG PUNCTURE is usually near the base of a square. Usually, only one egg is laid in a square, after which the hole is closed by packing it full of castings. A blister or swelling, that can easily be felt with the finger, is formed where an egg is laid. A few days after a square is punctured, it flares—that is, the bracts spread apart. In a few more days, the square turns yellow and falls off.

Control of Overwintered Weevils

Weevils overwinter in grass, trash, and leaves. They come out of hibernation from March until July. Many weevils die before squares are available. The weevils that emerge before squares are available feed in the terminal bud. Damaged plants send out side branches and soon recover.

Weevils can be readily seen in terminal buds of cotton plants. Insecticides may be applied when squaring begins, if an average of more than 1 weevil is found on 100 plants (180 weevils per acre). A second application may be made 1 week later if weevils are still present. These applications serve to thin out high populations of overwintered weevils but do not replace control later in the season. Applications should usually be confined to large, early cotton and to cotton near favorable hibernation quarters. Treating large areas and making repeated applications build outbreaks of bollworm, aphid and red spider without corresponding benefits in weevil control.

Trap Crops

Trap crops are often useful in concentrating overwintered weevils. A few rows of extra early cotton may be planted near hibernation quarters to attract weevils emerging from hibernation. Several insecticide applications may be made to these trap crops or to other small areas where weevils are concentrated in large numbers.

Overwintered weevils lay eggs in squares and soon die. The damaged squares may not be noticed until they flare, by which time the old weevils are usually dead. Infested spots should be marked to serve as a guide for later scouting and dusting.

Control of First Brood Weevils

About 5 weeks after squaring begins, a new brood of weevils emerges. They are the first to mature in the current year. After a week of feeding, they begin to lay eggs and to migrate short distances, usually within the field.

Beginning four weeks after squaring starts, squares should be inspected for fresh punctures once a week. Special attention should be given to spots where flared squares were found earlier. Most fresh punctures will be feeding marks. Egg-laying begins a few days later.

A boll weevil incubator is an aid in determining time of emergence of first brood weevils. To prepare an incubator the earliest squares that flare from punctures made by overwintered weevils are put in a screen wire cage in a place with average temperatures but out of the sun. A fruit jar may be substituted but is likely to be warmer than field temperatures. Squares should not be allowed to dry out.

Spot Dusting

In case of spot infestations, dusting should begin as soon as first brood weevils begin to emerge, as indicated by freshly-punctured squares. Infested spots and cotton for several yards in each direction are dusted. Applications should be repeated every 4 days as long as fresh punctures are found. Scouting should be continued, looking for new spots. Spot dusting gives maximum weevil control at low cost with little risk of bringing on outbreaks of bollworm, red spider, and aphid.

Blanket Dusting

If an infestation is generally distributed over a field (with 2 or more spots per acre), field wide or blanket dusting becomes necessary. In making counts to use as a basis for blanket dusting, 25 medium-sized squares are picked consecutively at one location. Flared squares or small squares are not included. An estimate of the infestation should be based on at least 200 squares in each 10 acres. Instead of picking 25 squares at each of several locations, squares may be picked at random while walking diagonally across a field.

With a moderate infestation and normal weather, applications should begin when about 25 per cent of the squares are punctured.

A rapidly-rising infestation is indi-

cated by feeding punctures and an increase in the percentage of squares punctured. Wet weather favors weevil development. *Dusting should begin when 10 to 15 per cent of the squares are punctured if it is a rising infestation in damp weather.*

A stagnant or falling infestation is indicated by egg punctures instead of feeding punctures and by little change or a drop in percentage of squares punctured. Dry weather kills weevil grubs and pupae in the squares. *With a stagnant infestation in dry weather dusting should not begin until 35 or 40 per cent of the squares are punctured.*

Repeat applications every 4 days until the infestation is brought under control. Keep scouting to determine progress of infestation and effectiveness of control. Watch for aphids, bollworms and red spider.

Control of Second Brood Weevils

About four weeks after the first brood weevils emerge the second-brood weevils begin to emerge from squares punctured by the first-brood weevils. The second-brood usually develops faster than the first, since temperatures are higher in July than in June. Second-brood weevils emerge before the last of the first brood die, and there is no weevil-free period at this time. Third and fourth broods follow in rapid succession. Heavy weevil flights occur when the supply of squares is exhausted.

Beginning 8 to 10 weeks after squaring becomes general in early cotton, cotton should be scouted at weekly intervals. A sudden increase in infestation indicates second-brood weevils emerging or migrating into a field. On early-maturing cotton, two or three applications for boll protection are highly profitable. Later cotton can be kept blooming with a regular dusting schedule.

In outbreak years like 1949 and 1950 second-brood weevils are so much more numerous than first-brood weevils that control is more difficult. However, regular dusting will enable infested fields to continue fruiting and will delay or prevent migration of weevils from them. This protects uninfested fields that would otherwise require control and makes it easier for all farmers to protect their cotton.

Dusting must continue until bolls are at least 16 days old. Quitting too early results in boll injury and loss of much of the benefit of control already accomplished. As plants mature, the percentage of punctured squares rises because of scarcity of squares. Boll protection can still be obtained, however.

Dusting for Weevil Control

In experiments over a 28-year span, the Arkansas Agricultural Experiment Station found that dusting for boll weevil control has more than doubled cotton yields. Dusting was done only in years of severe injury. Fields were chosen where there was active injury, and where infestation appeared to be increasing rapidly.

On the other hand, dusting when flared squares are seen, or in years of light weevil injury, is not profitable. Poor results under such conditions have destroyed the faith of some people in dusting to control boll weevil.

Dusting should be done at the right time, and applied properly, if it is going to be done at all. If aphid, red spider, or bollworm infestations develop and are allowed to go unchecked, damage from them may offset gains from controlling weevils.

Here are some further suggestions:

1. Even distribution of dust is essential. Bag-and-pole or similar methods are unsatisfactory.

2. Dust at four-day intervals. Repeat at once any application that is washed off by rain within an entire daylight period for calcium arsenate or toxaphene, or within four hours for 3-5-40.

3. Three or more applications are necessary to hold weevils in check where infestation is general. Do not quit dusting until scouting shows that the infestation is no longer rising and fresh punctures are not being made, or until the crop is safe with all bolls 2½ weeks old.

Spraying

Sprays may be used, although dusting is the preferred method. Like dusting, to be effective, sprays must be applied at the *right time and right place.* The almost complete failure of spraying by Arkansas farmers in 1950 can be largely attributed to a nearly complete disregard for correct timing. Low dosages, poor equipment, and improper adjustment of spray equipment also contributed to failure of the spray method to give control.

Spraying with concentrate sprays is

a new method and there are many unanswered questions concerning machinery, solvents, and emulsifiers. Sprays are likely to cause an increase in red spider populations. Furthermore, spraying has been used only during two relatively cool, wet summers and the results with other climatic conditions are not certain.

In spraying 1 to 10 gallons of spray are applied per acre. Older types of sprayers used for applying dilute water sprays are not satisfactory for applying these concentate sprays. Spraying can be done in a light breeze, making it possible to apply sprays during the day when it is too windy for dusting.

Section 2
Other Insects Affected by Boll Weevil Control

Beneficial insects help to control many pests of cotton. Common predatory insects are lady beetles, syrphid fly maggots, larvae of lacewing flies, the insidious flower bug, and the big-eyed bug. Parasitic insects are mostly small wasps and tachinid flies.

Insecticides that control boll weevil may kill these beneficial insects also. As a result, dusting or spraying for boll weevil may bring on outbreaks of aphids, red spider mites and bollworms. Calcium arsenate is quite destructive to chewing insects but does not kill the predatory bugs, such as insidious flower bug and big-eyed bug. The new organic insecticides kill all species of beneficial insects.

To avoid bringing on outbreaks of aphid, bollworms and red spider mites the following rules should be followed:

1. Do not use insecticides unless necessary.
2. Spot dust if infestations permit.
3. Learn to scout for aphids, red spiders, and bollworms.
4. Include 40% sulfur with dust mixtures of the new organic insecticides to prevent red spider build-up.
5. Include DDT in mixtures with BHC, aldrin or dieldrin.
6. Use calcium arsenate where boll weevil is the only problem, but watch for an aphid build-up.
7. Chemical defoliation will destroy aphid and bollworm infestations. It is especially helpful following heavy dusting or spraying schedules, provided the crop is sufficiently mature and other factors are favorable.

Aphids or Plant Lice

Aphids or plant lice are small, yellowish-green, soft-bodied insects found on the undersides of cotton leaves. They suck sap from plants and excrete honeydew, a sticky liquid on which sooty mold grows. Plants shed their leaves because of aphid feeding. Honeydew and the accompanying sooty mold lower the grade of the lint. Aphid infestation encourages bollworm infestation.

Aphids multiply rapidly. Fortunately, lady beetles and other insect enemies keep them under control most of the time. Dusting or spraying for boll weevils kills these beneficial insects, and aphid outbreaks often follow. However, spot dusting seldom leads to aphid outbreaks because the areas dusted are small and natural enemies migrate from undusted cotton.

With spot dusting, a close watch should be kept for aphid build-up. Whenever they increase to an average of more than 5 aphids per leaf, they should be knocked out with BHC.

With blanket dusting, insecticides that will prevent an aphid build-up should be used. This can be done by using toxaphene or 3-5-40 in every application. If calcium arsenate is being used for weevil control, 3-5-40 should be substituted as needed to prevent aphid build-up.

In dusting for aphid control air must be perfectly calm, with no rising currents. The fumes must remain among the plants. The hour between sunset and dusk is best for plane dusting. With ground machines, dusting may continue into the night. Low temperatures and excessive dew make early morning less desirable.

Red Spider

Red spiders are red or tan mites, barely visible to the naked eye. They live on the undersides of leaves and suck sap from leaves, causing the upper surfaces to turn red. In severe infestations leaves drop off. Dry weather favors red spiders. They cannot fly and they are spread through a field mechanically on cultivating equipment, etc.

Red spiders live through the winter on wild violet and other green plants. Thorough seed bed preparation and cultivation of ditch banks, fence rows and turn alleys and around stumps destroys plants they winter on.

Predatory and parasitic insects ordinarily keep red spider mites under control. New organic insecticides, like BHC, DDT, Toxaphene, Aldrin, and Dieldrin kill these beneficial insects but do not kill the red spider.

To prevent red spider build-up dusts of the new organic insecticides should contain 40 per cent sulfur. There is no satisfactory material to use in spray mixtures to prevent red spider build-up. To knock out an established red spider infestation dust the plants from below to cover undersides of the leaves using DN-sulfur mixture (0.5% dinitro-o-cyclohexylphenol). "Aramite," a new organic sulfur compound, looks good as a knockout for red spider.

Bollworm

Use of the new organic insecticides

Dosages of Insecticides For Boll Weevil

In the following table are given dosages of insecticides per acre. The first figure is for mid-summer applications on medium-sized cotton with moderate weevil infestations. The second figure is for heavy outbreaks on large cotton. To thin out overwintered weevils on small cotton when squaring begins, use half of the first figure.

Arkansas Recommendations for Bollweevil Control

INSECTICIDE	DUSTS		SPRAYS	
	Strength of dust	Amt. per acre	Strength of concentrate	Amt. per acre
Calcium arsenate	undiluted	7-10 lbs.	not used as spray	
Toxaphene	20%	10-15 lbs.	4 lbs. per gal. 6 lbs. per gal. 8 lbs. per gal.	2-3 qts.* 3-5 pts.* 2-3 pts.*
BHC-DDT	3-5-40	10-15 lbs.	Enough concentrate to furnish 0.3 to 0.5 lbs. gamma BHC and 0.5 to 0.8 lbs. DDT per acre	
Aldrin	2.5-5-40	10-15 lbs.	½ lbs. per gal. plus ½ lbs. per gal. DDT plus 1 lb. Aldrin—2 lbs. DDT mixture	1-1½ pt.* 1-1½ qt.*
Dieldrin	1.5-5-40 2.5-5-40	10-15 lbs. 10-15 lbs.	Enough concentrate to furnish 0.15 to 0.40 lb. dieldrin and at least 0.5 lb. DDT per acre	
Lime-free calcium arsenate Parathion DDT	about 75% 1% 5%	10-15 lbs.	not used as spray	

*This is the amount of concentrate. Dilute with enough water to spray an acre. From 1 to 10 gallons of water may be used for this.

Boll Weevil Calendar

(Intervals in weeks are approximate and will vary with weather conditions)

When to Act	What the Weevil Does	What Control Measures to Take
Just before the first squares set.	Weevils, if present, are in terminal buds waiting for squares.	Look for adult weevils in terminal buds of cotton plants. Where concentrations of adult weevils are found, dust once or twice.
Two to three weeks after squaring begins.	Overwintered weevils lay eggs in the first squares, which then flare (bracts spread apart). The grub and pupa stages are passed in them.	Scout for flared squares on the plants and on the ground to locate infested spots. Mark the infested spots.
Four to six weeks after squaring begins.	First brood weevils begin to emerge and feed. They should be killed before they begin to migrate and lay eggs.	Look for weevil punctures in each marked spot once a week. Begin spot dusting as soon as newly-punctured squares are found. If infestation is general, begin blanket dusting when justified by infestation count.
One week later.	First brood weevils begin to migrate short distances and to lay eggs.	Continue scouting at weekly intervals. If new spots are found, dust them. If other general infestations build up, dust them.
Eight to ten weeks after squaring begins.	Second brood weevils begin to emerge and feed.	Scout ALL cotton once or twice a week, watching for the general rapid rise in infestation that marks the beginning of emergence of second brood weevils. Dust as needed.
One week later.	Second brood weevils begin to lay eggs and to migrate. In weevil years, this is the late summer dispersal with heavy flights daily.	Continue regular scouting of all cotton. Where infestations justify dust at four-day intervals until crop is safe (with all bolls at least 16 days old).

destroys insidious flower bug, big-eyed bug and other predatory insects that help prevent bollworm outbreaks. Aphid outbreaks tend to bring on bollworms because bollworm moths are attracted to honeydew and because beneficial insects that might eat bollworm eggs are already busy eating aphids.

In scouting for bollworms, inspect terminal growth for eggs and small worms. The eggs are pearly white, oval and the size of a pinhead. The newly-hatched worms are small and brown with black spots. They tunnel through tender growth and puncture tiny squares. These tiny squares turn brown or black, resembling fleahopper injury. However, the small wormhole can be seen going through the bract (shuck) into the square. If 4 or 5 small worms plus additional eggs are found to 100 terminals, it is time to apply insecticides.

One-fourth to one-half grown worms bore into medium-sized squares, making an open hole the diameter of baling wire. Larger worms bore into bolls. They also like to feed in blooms.

DDT is the most effective insecticide for bollworm. Toxaphene is also good. Because large worms are extremely difficult to control, it is imperative that applications be made when worms are small.

Since BHC, Aldrin, and Dieldrin will not kill bollworms, DDT should be included in the mixture if these insecticides are used. If aphids are controlled, calcium arsenate is less likely to cause trouble from bollworms than are BHC, Aldrin, and Dieldrin.

Natural outbreaks of bollworm often occur independent of dusting operations. See Leaflet 98 for more complete information on bollworm.

Section 3
Recommended Insecticides

Satisfactory insect control may be secured by the proper use of a number of insecticides. In the Conference of Cotton Entomologists none of the recommended or substitute materials gave results which were distinctly better than any other. In the experimental work reported such variations as occurred were within the range of experimental error. Success in control still depends on timing.

Calcium arsenate — Excellent for boll weevil control. Repeat applications washed off before an entire daylight period. To prevent build-up of aphids use 3-5-40 as needed. Of the recommended insecticides, calcium arsenate has the best dusting properties and longest residual action. It also is the slowest killing one.

Lime-free Calcium arsenate—A special calcium arsenate suitable for mixing with the new organic insecticides. In other respects it is similar to regular calcium arsenate.

Toxaphene—Excellent for boll weevil control, good for bollworm control and prevents aphid build-up, if used in every application. Repeat applications washed off within four hours. Use 40 per cent sulphur in dust mixtures to prevent red spider build-up. Apply dusts in late afternoon, night, or early morning. Toxaphene is often used in sprays.

3-5-40 (3 per cent Gamma BHC-5 per cent DDT-40 per cent Sulphur)—Excellent for boll weevil and aphid control, and good for bollworm control. Repeat applications washed off within four hours. Include sulphur to prevent red spider build-up. Use in late afternoon, night, or early morning. With midday applications fumes of BHC are quickly dissipated and control is poor, despite the fact that many weevils are killed in open blooms. 3-5 mixture is also available in liquid formulations.

Substitute Insecticides

Because of a possible insecticide shortage in 1951, substitute materials are included. We can assume no responsibility for safe use of these materials. There have been several fatalities from parathion and frequent cases of illness. These have been reported by the manufacturer and are a basis of warning for careful handling. Less is known about possibilities of safe use of Aldrin and still less about Dieldrin.

Aldrin gave good results in most experiments for boll weevil control in 1950. It builds red spider and bollworm. In mixtures with DDT it builds aphids. It is quick-killing but slower than BHC. 2.5-5-40 (2.5% Aldrin, 5% DDT, 40% sulfur) is the preferred dust formulation. In Aldrin sprays DDT should be included for bollworm control. ALDRIN IS TOXIC BY SKIN ABSORPTION, INHALATION, AND INGESTION. IT IS RECOMMENDED FOR USE ON COTTON ONLY WHERE THOSE APPLYING IT ARE FULLY AWARE OF THE HAZARDS AND WILL FOLLOW THE PRECAUTIONS PRESCRIBED BY THE MANUFACTURER.

Dieldrin controls the same range of pests as Aldrin. It has longer residual action and is effective at somewhat lower strength. THERE IS LITTLE INFORMATION RELATIVE TO THE HAZARDS OF USING DIELDRIN. ALTHOUGH ITS POISONOUS EFFECTS

MAY NOT BE APPARENT IMMEDIATELY, IT MAY ACCUMULATE IN ANIMAL TISSUE AND ITS EFFECTS MAY BE DELAYED BY SEVERAL DAYS OR EVEN WEEKS. IT IS MORE POISONOUS BY SKIN ABSORPTION THAN BY INGESTION. IT IS SUGGESTED FOR USE ON COTTON ONLY WHERE THOSE APPLYING IT ARE FULLY AWARE OF THE HAZARDS AND WILL FOLLOW THE PRECAUTIONS PRESCRIBED BY THE MANUFACTURER.

Parathion is effective for aphid and red spider mites. It does not control boll weevil and builds bollworm outbreaks. 1% parathion plus 5% DDT in special calcium arsenate is an effective combination for boll weevil, bollworm, aphid and red spider mites. PARATHION IS AN EXTREMELY DANGEROUS POISON. IT IS NOT RECOMMENDED FOR GENERAL USE. HOWEVER, WHEN OTHER SUITABLE INSECTICIDES ARE NOT AVAILABLE AND IN OTHER EMERGENCY SITUATIONS, ITS USE ON COTTON MAY BE JUSTIFIED AND RECOMMENDED WHERE QUALIFIED PERSONNEL ARE IN POSITION TO ASSUME FULL RESPONSIBILITY AND TO ENFORCE PROPER PRECAUTIONS AS PRESCRIBED BY THE MANUFACTURER.

Control of Insects in —

• California

Shortages of sulfur and all chlorinated hydrocarbon insecticides are anticipated by the chemical industries in 1951. The changes in these recommendations from those of 1950 are made only to meet this situation.

The cotton grower is advised to use insecticides only when they are certainly needed. He is advised not to use them as insurance against insect infestations.

Goood control of cotton insects and mites will be obtained only when well-formulated dusts and sprays are thoroughly applied under quiet weather conditions. A competent flagman is essential and should insist on thorough treatment of infested *field borders* and the infested portion of the field.

Do not apply emulsibles in sprays when temperatures are 90° F. or above, or make any applications of insecticides when strong air currents prevail.

The California State regulations now require permits from the County Agricultural Commissioner for making applications of (1) Arsenicals in dust formulations by machine powered equipment, (2) TEPP in unconfined space as a thermal aerosol, (3) EPN and Parathion. If more than one pound of either EPN or Parathion is applied per acre the Commissioner will also require posted warnings and other health protective measures.

The recommended amounts of Parathion in the following schedule do not exceed three tenths (3/10) of a pound per acre per application, i.e., a maximum of 30#/A of a 1% Parathion dust. Two such applications four days apart are made, except for control of aphids, because the first is not effective after about three days for control of mites and insects hatching. Therefore there will be little more, if any, than three tenths (3/10) of a pound of actual toxicant on the cotton plants at any time.

Warning—phosphate insecticides such as EPN, Metacide, Pestox and Parathion are highly toxic to warm-blooded animals. These insecticides can be handled safely only if all precautions are observed. Preventive measures include the use of a suitable respirator (Mine Safety Appliances Co., Parathion respirator #CR 49290) to avoid inhalation of these chemicals and the use of impervious gloves to prevent contact with the bare skin. Workers should change their clothes completely and bathe with soap and water after using the materials, or if clothes become soaked. Any operators handling these phosphates or their formulations and developing symptoms of headache, shortness of breath, tightness of the chest, pin-point pupils, giddiness, nausea, diarrhea or related symptoms should be seen by a physician *at once*.

Note 1. Two pounds of Toxaphene in dusts or sprays in place of each pound of DDT recommended in dusts and sprays will give nearly the same control of Lygus bugs, fleahoppers and bean thrips. If Toxaphene is not available, two applications of 1% Parathion *dust* four days apart will give fair control of Lygus bugs, fleahoppers, thrips, aphids, Pacific mite and some control of two-spotted mites, *but will not give control of bollworms or other caterpillars.* The residue from one application will not persist through 5-7 days to kill the insects and mites hatching.

The use of Parathion in aircraft sprays is not recommended, due to health hazards.

Note 2. DDT has given better control of the cotton bollworm (corn earworm), several other caterpillars and bean thrips than other insecticides used for the control of cotton insects. At least three pounds of Toxaphene for each pound of DDT recommended are required for bollworm control. DDD(TDE) in the same concentration and formulations as DDT has given good control of corn earworms and other caterpillars on tomatoes. If all these chlorinated hydrocarbon insecticides are unavailable and a permit is obtained from the County Agriculture Commissioner, a 70% calcium arsenate dust at 30 pounds per acre may be used for control of these caterpillars. Parathion, BHC, Lindane, Aldrin and some other newer insecticides have not given good control of most caterpillars that attack California cotton.

For most of our cotton insects with the exception of the bollworm, the application of one pound of actual DDT per acre will prevent a reinfestation for one month. The interval between applications of DDT for control of the bollworm is close to 2-3 weeks from about late July into early September.

The bean thrips is usually a serious pest in the west and northwest part of the San Joaquin Valley where Lygus bugs are the least serious and, therefore, a *mid-July application is usually the most timely there.* In the south and southeast part of the San Joaquin Valley where Lygus bugs are serious pests, *two applications, one near the first of July and another a month later,* are *the most timely ones,* but should be timed to *follow* the cutting of nearby alfalfa or

California Recommendations for Insect Control

Insect	Recommended Insecticide	Time of application or injury	Rate of application or remarks
Red spider mites: Atlantic mite	Sulfur dust	Very common throughout the season	15-30 lbs. per acre depending on equipment and size of plants. Sulfur at 15 lbs. per acre should be used in mixtures with other insecticides whenever this mite and insects are to be controlled.
Beet armyworm. Cutworms, Small darkling beetles	5% DDT dust or 1 lb. DDT per acre in spray	Young cotton (seedlings)	10-20 lbs. per acre depending on the ground equipment. 4-6 gals. spray per acre.
False wireworms Seed-corn maggot Wireworms	None certain	Young cotton (seedlings)	Seed treated with chlorinated or phosphate insecticides has given some promising results.
Hornworms, larvae of white-lined sphinx moths	5% DDT or 10% Toxaphene dust or sprays to give 1 lb DDT or 2 lbs. Toxaphene per acre	Young cotton (seedlings)	As barriers or on plants, applied by ground equipment. 4-6 gals. per acre.
Thrips: onion and western flower Cowpea aphid ("black aphid")	None	Young cotton (seedlings)	Insecticides require too many applications to be practicable. Toxaphene, 2 lbs. actual per acre in sprays has been the most promising.
Lygus bugs Fleahoppers	5% DDT dust or See Note 1.	June to about August 15	20 lbs. per acre by ground equipment, 30 lbs. per acre by airplane.
Yellow-striped armyworm	5% DDT dust	About July 15 to Sept. 1	20 lbs. per acre by ground equipment. Border strips to protect against migrations.
Bollworm Bean thrips	5% DDT dust or See Note 2.	Throughout season but usually July through Sept.	25 lbs. by ground equipment. 35 lbs. by airplane.
Pacific mite	1% parathion 50% sulfur dust	Occasional in mid to late season	30 lbs. per acre. Two applications four days apart if max. temperature average 95°F or above.
Two-spotted mite	None certain	Occasional mid to late	New chemicals show only fair results. 3% Aramite dust and 1% parathion dust have given better results than others to date.
Cotton aphid	1% parathion dust 1% TEPP dust 1% BHC dust	Occasional June to Oct.	10-30 lbs. per acre depending on equipment and size of plants. See nicotine dusts under **cotton aphid.**

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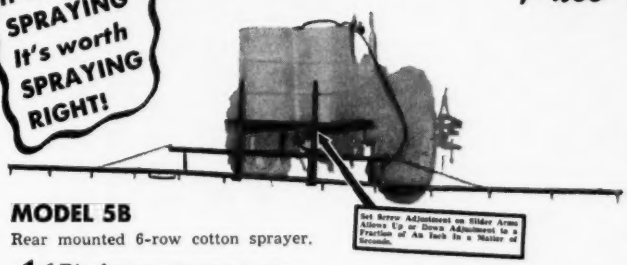

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Rear mounted 6-row cotton sprayer.

- Diaphragm pressure regulator designed to give EASY, ACCURATE PRESSURE ADJUSTMENT.
- Chemical resistant hose.
- All models designed to mount either on REAR of TRACTOR, FRONT of TRACTOR or on rear of TRAILER.
- Some models complete with DROP EXTENSIONS.
- Some models have ADJUSTABLE WIDTH spacing for NOZZLES and drop extension for VARIOUS ROW WIDTHS.
- Not just single season sprayers—built to last for years.
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- All sprayers designed to give COMPLETE COVERAGE of foliage.
- Two row EXTENSIONS available on all models. Low cost TRAILER MODELS and two row CULTIVATOR MODELS available.
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- Pump is gear type, special bearings require NO GREASING.
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- Boom height EASILY adjustable. Extra WIDE RANGE of boom height adjustment.
- Spray booms of NONCORRISIVE material.
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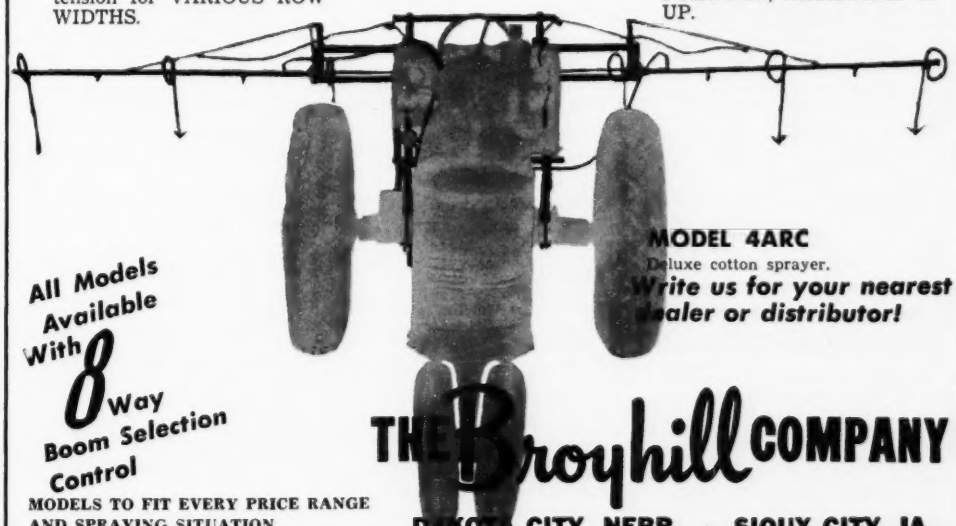

MODEL 4ARC

Deluxe cotton sprayer.

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All Models Available With 8 Way Boom Selection Control

MODELS TO FIT EVERY PRICE RANGE AND SPRAYING SITUATION.

THE Broyhill COMPANY

DAKOTA CITY, NEBR. - SIOUX CITY, IA.

harvesting of potatoes by not more than one week.

Lygus bugs or "cotton daubers" are attracted to succulent or rank-growing cotton. The current changes in the cultural practices due to the mechanization and to the new variety of Acala 4-42 may advance the timing of insecticide applications for control of Lygus bugs and other insects. This insect feeds only on squares and small bolls which it may cause either to fall from the plant or remain on it and develop into deformed flowers and bolls. This injury produces an increase in the growth of leaves and stems and causes loss in quantity and quality of early fiber.

Similar types of "shedding" and growth are produced by: an excess of nitrogen particularly with an excess of water; the stress caused by long intervals between irrigations or a like effect due to soil type and water penetration; deep cultivations which destroy surface roots.

When an average of 5 per cent of the white blossoms have petals which show the crinkled and warty surface and the brown spots on the inner floral parts, the infestation is sufficiently heavy for control measures to be taken. Control measures should also be taken if a 14-inch diameter insect net properly swung 50 times through the tops of one row collects an average of six young and adult Lygus bugs.

The cotton bollworm or corn earworm has been a more serious pest of cotton during the past few years. The buff colored moth lays 500-3000 eggs at dusk on the tips of new growth which have no insecticide on them if the application was made only a few days previous to this time. By the time the worms hatch and feed on the tiny squares in the tips, any insecticide has rapidly weathered off the plant. Heavy infestations in the tips may show up two weeks after an application of DDT, DDT is much more effective and economical pound for pound than any of the other insecticides. If an average of 4-5 of these small worms can be found by examining 100 terminals, DDT should be applied. The worms proceed down the plant attacking many bolls which are completely destroyed either by the worm or by fungus which follows their attack "boll rot." The full grown worms burrow into the soil and transform into a moth that starts laying eggs about 2 weeks after the worm stopped feeding. Little if any benefit will result from insecticides applied when the worms are nearly fullgrown.

During the past four seasons insecticides have been applied in concentrated emulsible form with water as the diluent and applied at either 5 or 10 gallons per acre. DDT, Toxaphene, Chlordane, TEPP, and BHC, were applied by fixed wing planes with booms or brushes, helicopter with boom, and some with row-crop spray equipment. The results have been very comparable to those where the same amount of insecticide was applied in dust mixtures, but no satisfactory material has been found for use in this concentrate for control of spider mites. The amount of sulfur required is too bulky to be kept in suspension by the aircraft equipment. TEPP (tetra ethyl-pyrophosphate) in dusts and sprays and 1 and 2 per cent parathion in dust have not given satisfactory control of the Atlantic mite. The two-spotted mite, *T. bimaculatus* Harvey, and the Pacific mite, *T. pacificus* McG. are not controlled by sulfur dust. The two-spotted mite is the most difficult to control of the three species common on cotton in California. No chemical has given satisfactory control to date. The injury of leaves is intermediate between that of the smaller dense colonies of the Atlantic mite and the uniformly scattered and heavily webbed character of the Pacific mite. The Pacific mites and two-spotted mites are blown into the tops of cotton plants from infested crops and weeds in mid-season and cause a grayish appearance due to webbing, stunted growth, and leaf injury. One per cent parathion dust has given good control of the Pacific mite on cotton when two applications are made with a four-day interval. Parathion is toxic to the two-spotted mite and the two applications by ground equipment have given good control. By aircraft the control has been poor.

The following insecticides are compatible one with another and may be used together in dust or spray combinations: DDT, Toxaphene, Chlordane, benzene hexachloride (BHC), parathion, sulfur. They are not compatible with lime-sulfur or other strongly alkaline materials. Combinations of these have not given better results on cotton except for the combination of sulfur with one of the others, as previously shown in this article. The emulsibles and the wettable powders have the correct amount of wetting agents in them and none of these additives should be used unless the package label specifies one. The combination of phosphate insecticides with oil sometimes results in plant injury and is more apt to be absorbed through the skin of those who handle them. For most insects on plants, oils are not recommended with the insecticides mentioned above. Moisture on the plants at the time of application may decrease the efficiency of sprays or dusts.

Injury has occurred on cotton by airplane spraying with the emulsible insecticides when temperatures were around 90° F. and above. The same combinations applied at lower temperatures, evening and early morning, did not burn the foliage.

Applying insecticides for the control of thrips and the cowpea aphid on young cotton has so rarely shown any benefit that the cotton grower is advised against it. Concentrated emulsibles applied by airplane at the rate of 5 gallons of spray, containing 2 pounds of actual Toxaphene, per acre has given the best results to date.

The cotton aphid may seriously stunt plants and reduce yields. It often becomes so numerous near harvest time that the honeydew on fiber interferes with both machine and hand picking. It also interferes with ginning and reduces the quality. Insecticides which give satisfactory aphid control are expensive. Infestations may often be kept from becoming widespread by spot dusting in the early season. Nicotine dust, No. 10, gives good results in warm, quiet weather. One per cent parathion in pyrophyllite and the same per cent with sulfur has given good control of the cotton aphid on cotton. The experimental work of including aphicides in mixtures used for control of other insects in July and August has shown no benefit in preventing the September aphid infestation. Toxaphene has been too uncertain to recommend for aphid control. Due to health hazards and preservation of beneficial insects Nicotine No. 8 or No. 10 dusts are recommended for small dusting equipment.

Control of Insects in—

• Georgia

Recommended Dusts for Boll Weevil Control

(1) BHC-DDT—A mixture containing 3% gamma isomer of benzene hexachloride and 5% DDT (3-5 mixture). Use at the rate of at least 10 pounds per acre all applications.

(2) Toxaphene—A dust containing 20% technical toxaphene. Use at least 10 pounds per acre all applications.

(3) Calcium Arsenate in alternate applications with BHC-DDT (3-5 mixture). Use calcium arsenate at the rate of 7 to 10 pounds per acre. Apply BHC-DDT at 10 pounds per acre.

(4) Aldrin-DDT—A mixture containing 2.5% aldrin and 5% DDT. Use at least 10 pounds per acre all applications. Under extremely hot conditions, especially in south Georgia, the rate per acre should be increased to 15 pounds.

Any of the above insecticide mixtures will control boll weevil, fleahopper, and cotton leafworm if properly applied. When certain of these are used other pests have to be considered (See bollworm, cotton aphid, and red spider mites). In unusually large or rank growth cotton the recommended number of pounds should be increased. Due to the possible short supply of sulfur during 1951 this material is not recommended in the above mixtures. Inert materials are recommended as the diluent instead of sulfur which has been included in the past for red spider control.

Hand guns, horse-drawn, and tractor mounted dusters or airplane dusting are all satisfactory for application.

Recommended Sprays for Boll Weevil Control

(1) Toxaphene or Toxaphene-DDT — Apply toxaphene at the rate of 2 pounds of technical toxaphene per acre. Where DDT is included in the concentrate the rate per acre of DDT will vary from 0.5 to 1 pound depending on different manufacturers' formulations.

(2) Aldrin-DDT—Apply at the rate of 0.25 pound aldrin and 0.5 pound technical DDT per acre.

(3) BHC-DDT—Apply at the rate of at least 0.3 pound gamma isomer BHC and 0.5 pound technical DDT per acre.

Any of the above insecticide mixtures will control boll weevil, fleahopper, cotton leafworm, and thrips, if properly applied. When certain of these are used other pests have to be considered (See bollworm, cotton aphid, and red spider mites).

Other Insecticides for Control of Boll Weevil and Certain Other Insects

Dieldrin — This insecticide has been tested for only one year in Georgia. The use of 1.5% dieldrin plus 5% DDT is not recommended for general use in Georgia during 1951 and is to be used experimentally only. The dust mixture of 1.5% dieldrin plus 5% DDT used at the rate of 10 pounds per acre or a spray used at the rate of 0.15 pound dieldrin and 0.5 pound DDT per acre, will control boll weevil, fleahopper, thrips, and certain other injurious insects. Although aphids have not been serious there is an indication they may build-up following the use of this mixture.

Dieldrin is regarded as highly toxic to

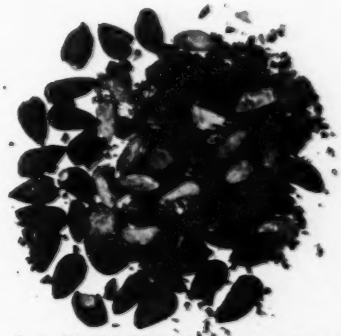
Appearances ARE OFTEN DECEIVING

SINKERS PROCESSED
COTTONSEED

GAS OR DRY PROCESSED
COTTONSEED

Especially IN DELINTED COTTONSEED

SINKERS PROCESSED COTTONSEED
AFTER RUB TEST



GAS OR DRY PROCESSED COTTONSEED
AFTER RUB TEST

• MAKE THIS RUB TEST YOURSELF BEFORE BUYING •

Rub a small handful of delinted seeds firmly between the palms of your hands. Be sure to notice that SINKERS COTTONSEED NEVER BREAKS UP.

THE SINKERS PROCESS...

is the only method whereby cottonseed can be perfectly delinted, graded and treated, without damage to the seed.

CAUTION...

Any breaking up of the seed indicates that the seed has been burned and charred —THIS MEANS TROUBLE.

REMEMBER—The seed coat protects the germ-life and permits absorption of the exact amount of moisture needed for germination under growing conditions.

THE SINKERS CORPORATION
KENNETT, MISSOURI

COTTON INSECTS

How to Identify Them and Evaluate Their Damage

COTTON INSECTS have only two aims in life, to eat and reproduce. We have let them get away with it for a long, long time and it is only in very recent years that cotton farmers have really waked up to the fact that they have the weapons and the know-how to hold these enemies in check.

Prior to 1947, for example, we afforded ourselves only small protection against insects. Fact is, we used less than 40 million pounds of insecticides a year until 1948. But with the development of the new organic insecticides, improved equipment for applying them, and through the untiring efforts of research entomologists throughout the Cotton Belt, there came a radically new concept of the whole insect problem and a much clearer understanding of what effective control means in dollars-and-cents return from a cotton crop. How far we have come shows up in the fact that in 1950 farmers used insecticides—both dusts and sprays—in the amount of approximately 500 million pounds of dust equivalent.

One of our greatest needs, in addition to even more knowledge about insecticides and the application of them, is an intimate familiarity with cotton insects on the part of the cotton farmer. In order to be able to follow an approved control program in the most effective manner, the farmer must know what cotton pests look like, what their habits are, and how to evaluate the damage they cause.

The pictures on this and the following three pages show the principal cotton pests and were made available for use here through the courtesy of Hercules Powder Company, makers of technical toxaphene. A careful study of these pests and the accompanying text will pay big dividends to everyone who will have a part in carrying out the intensive plans now being drawn up to effectively control cotton insects in 1951.

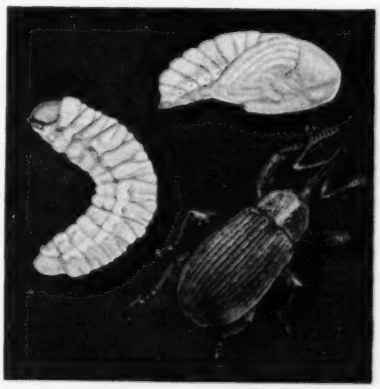
Boll Weevil

Anthonomus grandis Boh.

THIS INSECT causes more damage to cotton in the United States than any other insect. Its damage is known to cotton growers from Texas to Virginia.

The adult, a grayish-brown snout beetle about ¼ in. long, feeds on squares, bolls, or terminal buds. The white grub of about the same size feeds in the squares and bolls.

Weevils hibernate mostly under leaves and trash in woods, fence rows, and ditch banks near last year's fields. While recommended insecticides, properly applied, give effective control, it is advisable to follow other good farming practices in combating this pest. Harvesting promptly and cutting the green stalks as much before frost as possible hold down the weevil population. Correct planting, fertilizing, and cultivating methods help to keep ahead of the boll weevil in the spring.



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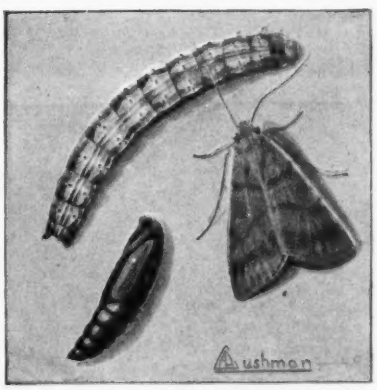


Approximately 2 times actual size

Bollworm

Heliothis armigera (Hbn.)

THE BOLLWORM is a major cotton pest. The tiny newly-hatched worm first feeds on leaves and then attacks squares and bolls. Greatest loss is caused by tunneling into and destroying bolls. The color varies from pink, green, to almost black. The full-grown worm, about 1½ in. long, enters the ground and becomes a mahogany-brown pupa from which the adult later emerges. A generation may be completed in 30 days during warm weather, with 4 to 6 generations annually. Control should start as soon as eggs and newly-hatched worms are found.

The adult is a yellowish to brownish moth (often with a strong greenish overcast which fades in flown specimens) with a wing spread of about 1½ in. The female lays about 1,000 eggs singly, particularly on growing tips, squares, and bolls. The small, ribbed eggs are white, dome-shaped, and about half the size of a pinhead.

Greatly enlarged

Cotton Fleahopper

Psallus seriatus (Reut.)

THE FLEAHOPPER pierces terminal buds and newly-formed squares, causing them to drop. This often results in tall, whiplike plants without fruit or fruiting branches, or other abnormal plant growth. Injury occurs chiefly in early season.

The adult cotton fleahopper is an oval-shaped, pale-green winged insect about 1/7 in. long. The body is dotted with small dark spots with four black marks near wing tips. The young fleahopper is very small, green, and wingless.

The fleahopper breeds on goatweed (croton), primrose, horsemint, and other plants. Eggs are inserted singly in the bark of stems. A life cycle is only about 3 weeks; several generations mature during the year. It winters in the egg stage. One field of goatweed may hatch millions.

If fleahoppers are preventing the set of squares when the first squares begin to form, control should be started at once.

Thrips

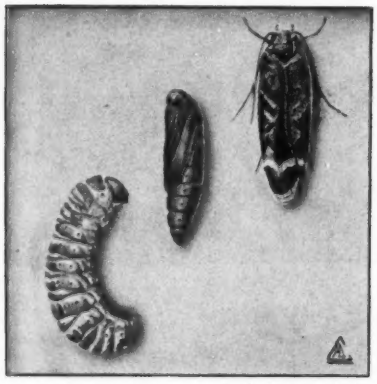
Thrips tabaci Lind

ONION THRIPS are usually about 1/20 in. long. The adults of all thrips are easily identified by narrow, fringed wings. Several other species also attack cotton, including flower thrips, *Frankliniella tritici* (Fitch), tobacco thrips, *F. fusca* (Hinds), and bean thrips, *Hercothrips fasciatus* (Perg.). These vary in color from light-yellowish to almost black.

Thrips cause injury to leaves and terminal buds. Young leaves are left ragged and often cup-shaped by feeding thrips. Damage to seedling plants usually results in severe stunting, excessive branching of terminal growth, and sometimes will kill the plants outright. Later infestations may sometimes cause shedding of leaves, and even squares and young bolls.

Thrips attack many plants, including weeds and the small grains. They usually migrate to adjacent cotton, when such crops are harvested or become mature. Weeds on ditch banks or fallow land near cotton also provide a source of thrips infestation.

Greatly enlarged



4½ times actual size

Pink Bollworm

Pectinophora gossypiella (Saund.)

ALTHOUGH the pink bollworm is the most important cotton pest world-wide, fortunately it is confined in the United States to only a small area. It causes hardly any damage to U.S. commercial crops because of a strict regulatory federal-state cooperative control program.

This program calls for strict quarantine measures, including seed sterilization, burning of gin trash, control over time of planting, and destruction of stalks. Through control programs, the pest has been eradicated from many areas, including sections of northern Florida, southern Georgia, and Louisiana. The pink bollworm now occurs only in limited areas of commercial production in the Southwest, and in some places where "wild cotton" occurs in southern Florida.

Imports of cotton and cotton products from abroad are also controlled through quarantine to keep the pest out of this country.

The small pinkish or whitish caterpillar feeds in the cotton seed. This results in complete or partial destruction of the bolls, and a decided reduction in quality of seed and lint. In severe infestations, squares and bolls are shed as under boll weevil attack.

Cotton Leafworm

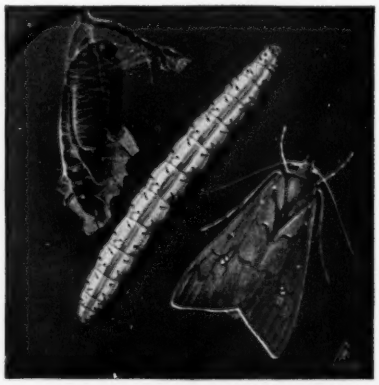
Alabama agrillacea (Hbn.)

THIS is a familiar cotton insect, and its presence is seen by ragged or stripped leaves.

The full-grown worm is about 1½ in. long, greenish with white and black stripes, and with black spots over its body. Its half-looping crawl is characteristic.

The leafworm is a tropical insect. The moth or miller migrates to the cotton belt each season. It usually appears first in south Texas in April, May, or June. Eggs are laid on the underside of the leaves. Worms hatching from these eggs become full grown in 2 or 3 weeks. The worms change into brown pupae in folds of the leaves. In about a week, the moths emerge and a new life cycle begins. The insect has 3 to 6 generations in one season. Wet weather is favorable to leafworm outbreaks.

Insecticides should be applied when worms first appear if bolls are not full grown.



2 times actual size

Greatly enlarged

Cotton Aphid

Aphis gossypii Glov.

THE COTTON APHID is a common species of plant louse, which feeds on cotton and many other plants. It is a small, soft-bodied, sucking insect varying in color from light-yellow to almost black. In the South, females give birth to living young throughout the year. During hot weather, a generation may be completed in a week's time. Most adults are wingless, but sometimes winged forms appear.

The aphids usually feed on the underside of leaves and on stems. Injury to cotton may first occur on seedling plants in cool weather, deforming, stunting, or even killing the young plants. Later, heavy infestations may cause shedding of leaves and a marked decrease in yield. The aphids' sticky secretion called honeydew drops on open bolls, staining lint and lowering the grade. Many natural enemies, including lady beetles, aid in keeping aphids in check.

Rapid Plant Bug

Adelphocoris rapidus (Say)

INJURY to cotton by the rapid plant bug is primarily caused by piercing squares and young bolls. Greatest loss is destruction of young squares, producing injury similar to that of the cotton fleahopper. Some damage occurs through piercing the terminal buds, leaves and stems of the plants, resulting in malformations. Its damage is similar to that caused by the fleahopper, tarnished plant bug and other lygus bugs.

The adult bug is about 1/3 in. long. Its color is dark-brown with a narrow yellow band along the sides of the body. The early stages are light-green with red markings.

Eggs are laid in the stems of plants, and there are several generations annually. Winter is spent in the egg stage.

5½ times actual size

Greatly enlarged

Two-Spotted Spider Mite

Tetranychus bimaculatus Harvey

THIS is one species of a group generally known as spider mites. When leaves of the cotton plant become blotched with red or yellow spots, the presence of these mites may be indicated. Heavy infestations often result in the leaves turning a rusty, brownish (or red) color, later shedding from the plants. Sometimes, squares and bolls shed also.

Spider mites are barely visible to the naked eye. Their color may be red, reddish-yellow, yellow, or greenish. The mites are found on the underside of the leaves where they suck the sap of the plant, spin filmy webs, and lay their eggs. They have a number of generations each year. Besides cotton, spider mites attack almost 200 other plants. Hot, dry weather is most favorable for outbreaks. Heavy rains may effectively check them.

Differential Grasshopper

Melanoplus differentialis (Thos.)

GRASSHOPPERS attack all kinds of crops including cotton. When abundant, they may destroy thousands of acres of cotton or other crops in a community.

There are many species of grasshoppers. The differential grasshopper is probably the most important attacking cotton. The adult insect ranges in length from 1½ to 2 in. Its color is brownish-yellow, often tinged with olive-green. Hind legs have distinct V-shaped bars on outer sides.

Eggs are laid in pods in the ground during late summer or fall, usually in fallow land, in pastures, or on turn rows. When hatched in the spring, the young grasshoppers feed first on grass and weeds, and then transfer to field crops.

Control should be started while hoppers are small, and before migration to field crops occurs.

Actual size

5½ times actual size

Tarnished Plant Bug

Lygus oblineatus (Say)

THIS BUG pierces plants and feeds on the sap with its piercing-sucking mouth parts. The adult insect is about ¼ in. long, brown in color and mottled with yellow, black and red. Young bugs are green. They develop rapidly, gradually assuming the appearance of adults.

They damage cotton by blasting young squares, preventing normal growth and resulting in malformed plants.

Winter is passed in trash and debris of various kinds. Eggs are laid in the tissues of plants. A generation of the insect may be completed in 3 or 4 weeks. Several generations may occur in one season.

(See also Lygus Bugs)

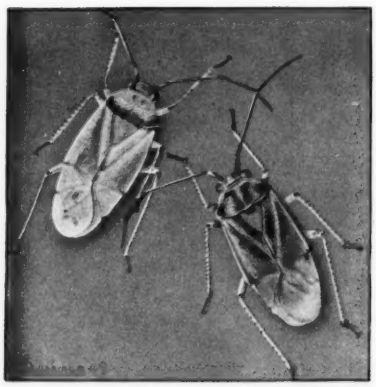
Lygus Bugs

Lygus elisus Van D. *Lygus hesperus* Knight

THESE BUGS are important pests of cotton in the Southwest. Alfalfa is a favorite host of these insects. When alfalfa or other plants are cut or dried out, lygus bugs migrate to adjacent cotton fields. Their feeding on cotton results in the shedding of squares, blooms, and young bolls. The plants also become deformed.

The adult females are straw-colored while the males are darker with red and brown markings. They are almost ¼ in. long, slightly smaller than the tarnished plant bug. Eggs are laid within the tissues of the plants upon which they feed. Under favorable conditions, a generation may be completed in 30 days. There may be 6 or more generations in a season.

(See also Tarnished Plant Bug)



5½ times actual size

2½ times actual size

Conchuela

Chlorochroa ligata (Say)

STINK BUGS of various colors and markings are familiar pests. Several kinds attack cotton. These insects usually increase on other plants and transfer to cotton late in the season. Migrations occur particularly from such crops as grains and legumes.

Chief damage is caused by puncturing bolls and sucking juices from the seed. The bolls may be wholly or partially ruined. Seed and lint produced from partly-injured bolls are inferior. Stink bugs also cause shedding of squares and young bolls.

The conchuela, shown above, is the most destructive of the stink bugs that attack cotton but fortunately occurs only in the Southwest. Other stink bugs that are serious pests of cotton include the Say stink bug, *Chlorochroa sayi* Stal, of the Southwest; the southern green stink bug, *Nezara viridula* (L.), of the Southeastern states; and brown stink bugs, *Euschistus* spp., that occur wherever cotton is grown in the United States.

Stink bugs pass the winter as adults, usually on the surface of the soil under leaves and debris. Several generations are completed annually.

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Sixteen million bales — probably the biggest crop we have ever been called on to produce — an increase of more than six million bales over last year.

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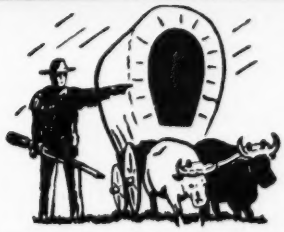

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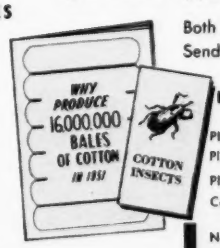

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man and animals and is readily absorbed through the skin. Extreme precautions should be exercised when handling and applying dieldrin.

Calcium Arsenate plus 1% Parathion —A special lime-free calcium arsenate containing 1% parathion dust has been used experimentally and has given satisfactory control of boll weevil, aphid, and red spider at the rate of 10 pounds per acre.

Parathion is extremely toxic to man and should be handled with caution. This material should not be used unless the operator follows the special precautions on the use and application of parathion (See Precautions).

Clordane-DDT — Results using chlordane have been erratic. It is not recommended except in such areas as have had success with its use heretofore. Under north Georgia conditions the 10% chlordane-5% DDT has given satisfactory results. This mixture applied at the rate of 10 pounds per acre will control boll weevil, fleahopper, and thrips. Aphids may build-up following the use of this material.

Timing of Applications for Boll Weevil Control

Pre-Square: Early applications are recommended where boll weevil, thrips, fleahopper, or other injurious insects are numerous early in the season.

After Squaring Begins: When squareing begins examine the fields. If punctured or flared squares are readily found, apply any of the recommended materials. In most years the regular schedule commences with this application. Applications should be made at *four* to *five* day intervals until the infestation is brought under control. This will probably require at least three applications. Fields should be watched closely and poisoning resumed when reinfestation occurs. Presence of insects and weather conditions will determine the total number of applications during the season. *Do not stop too early.* If conditions are such that ground equipment will damage the plants fenders or guards should be used. When it is impossible to get in the field late in the season, airplane application is recommended. If rain occurs within 24 hours after poisoning, repeat application within 48 hours.

Other Insects

Bollworm

As soon as squares with small holes in them are found apply a dust of either 10% DDT or benzene hexachloride 3% gamma isomer and DDT 10% (3-10 mixture) at the rate of 10 to 15 pounds per acre. The BHC-DDT (3-10) controls both boll weevil and bollworm. Under certain conditions 20% toxaphene will control bollworm. When spraying is being practiced and the emulsifiable concentrate used does not contain DDT, add sufficient concentrate to give 1 to 1.5 pounds of technical DDT per acre. Prompt action is essential as large worms are difficult to kill. Late season applications are particularly important for control of bollworms.

Aphid

Where a build-up of aphids or lice occurs apply BHC-DDT (3-5) or 1% parathion dust (See precautions). Where sprays are being used apply BHC or tetraethyl pyrophosphate (TEPP). TEPP may be combined with other spray formulations and is used at the rate of 0.5 pint of 40% TEPP per acre.

Red Spider

One or more applications of 15 to 20 pounds of dusting sulfur per acre should be used in case of a build-up of this pest. A 1% parathion dust, or a spray containing TEPP may be used. Use same rate of TEPP as recommended for aphid.

Thrips

In some areas thrips may seriously injure seedling cotton. This insect may be controlled with the dusts or sprays recommended for boll weevil control, except calcium arsenate. Where toxaphene spray applications are made to seedling cotton 1 pound per acre is sufficient to control this insect.

Spraying

Insecticides may be applied in the spray form and give equal results to dust when the pounds per acre of the actual material remain comparable. Emulsifiable concentrates when mixed with water give an emulsion satisfactory for spraying. The concentrate should be diluted according to the manufacturers' directions using the recommended pounds of insecticide per acre.

Sprays may be applied by horse-drawn or tractor mounted *low-pressure* and *low-gallonage* sprayers, or by airplane. A nozzle of the hollow cone type should be used and the equipment operated at the manufacturers' specified pressure. Sufficient pressure should be maintained in order to give a good spray pattern. This may vary from 40 to 60 pounds pressure. The amount of spray per acre will vary with the type, and speed of equipment, and number of nozzles per

row, but is usually three to nine gallons. For airplane application one to two gallons of spray is satisfactory.

The number of nozzles needed per row will depend on the size of the cotton plant. For seedling cotton, one nozzle per row with ground equipment is suggested, with 2 nozzles on cotton up to 20 inches high, and 3 nozzles on plants over 20 inches. Nozzles should be kept from 8 to 10 inches from the plants to insure a proper spray pattern. For effective coverage, the nozzles should not drag in cotton plants.

Sprays should be applied only when the plants are dry. Applications may be made under conditions of relatively strong winds (15 miles per hour). As a safety measure, it is recommended that the spray boom be mounted to the rear of the operator.

It is important to mix emulsifiable concentrates with water before adding to the spray tank. Measure the desired amount of concentrate, add to water in a suitable container, and stir thoroughly. Pour this mixture into the partly filled spray tank and complete filling with water. Agitate the finished spray by pumping back through the overflow into the tank. Thorough mixing is important before the spray operation begins. *Do not add the spray concentrate directly to the tank without previous mixing with water.* The spray equipment should have a pump with an overflow or bypass or mechanical agitator to give continuous agitation during the spray operation. Do not use insecticides in the form of wettable powders or dusts in low-gallonage and low-pressure cotton sprayers; use only emulsifiable concentrates.

General

1. Machines for catching boll weevils and other insects are not recommended.

2. A heavy dew is not essential for satisfactory dusting conditions, but the air should be calm.

3. Good boll weevil control is considered when the infestation is 10 percent or less. A simple way to make infestation counts is to pick at least 100 nonflared squares for each 5 acres as you walk diagonally across a field, picking equally from top, middle, and lower limbs. The number of punctured squares out of each 100 picked is the percent infestation for that count.

Precautions

1. All insecticides used for control of cotton insects are poisonous and should be handled with caution. Read carefully all labels on packages or containers before using any insecticides. Avoid body contact and inhaling dust or fumes with these materials. *Liquid insecticides spilled on skin or clothing are extremely dangerous.* If this occurs immediately remove clothing and bathe thoroughly with plenty of soap and water.

2. Avoid excessive drift of insecticides onto adjacent fields where animals are pastured or where food or feed crops are grown. Most insecticides are also toxic to poultry.

3. Care should be exercised to avoid poisoning honey bees through careless use of insecticides. Nearby beekeepers should be notified before poison applications are made, whenever possible.

4. Insecticides will kill fish if allowed to drift onto or drain from cotton lands into ponds or streams.

5. Special precautions should be taken in handling TEPP and parathion to avoid prolonged contact with the skin or breathing the vapors from either spray or dust.

6. Parathion is highly toxic to human beings. It is poisonous if swallowed, inhaled, or absorbed through the skin. *The precautions printed on the package are for your protection and should be followed carefully.* In applying parathion a respirator should be used to avoid inhaling the material. A dust and vapor type respirator is suggested and may be obtained from the following companies:

American Optical Company, Southbridge, Mass., Chemical Cartridge Respirator, No. R-5055.

Mine Safety Appliances Co., Pittsburg 8, Pa., Chemical Cartridge Respirator, No. Cr-45779.

Wilson Products Company, Reading, Pa., Chemical Cartridge Respirator, No. 701.

If certain symptoms of illness appear a doctor should be consulted at once. The antidote (atropine) known to be especially effective in the case of parathion should be carried by those using the chemical, or available for immediate use if needed. See label on containers for symptoms and treatment.

For additional information contact your county agent, vocational agricultural teacher, veterans instructor, or the nearest experiment station.

Formulated by entomologists and agronomists of the University System of Georgia and representatives of the State Department of Agriculture.

Control of Insects in—

• Louisiana

The major cotton pests in Louisiana are the boll weevil, cotton aphid (lice), bollworm, and cotton leafworm. Less important are the cotton fleahopper, tarnished and rapid plant bugs, thrips, and spider mites. There are several insecticides which will give adequate control of these pests. *The time at which control operations are begun, the interval between applications, the thoroughness of application, and continuing applications as long as needed are more important for successful cotton insect control than the particular kind of insecticide used.*

Boll Weevil

The boll weevil is the number one pest of cotton in Louisiana. No other cotton insect should be considered as being of equal importance. Cotton insect control operations should center around a sound boll weevil control program.

Infestation counts should be made at least once a week. This is the only way to accurately determine when insecticide applications should be started and how long they should be continued.

To obtain the most effective boll weevil control *every* cotton grower should make infestation counts and apply insecticides where needed.

Poisoning for the Overwintered Boll Weevil: Where overwintered weevils are abundant, make an application of a recommended insecticide when squaring starts. Make additional applications 7 to 10 days apart, where needed. It is a waste of time and money to poison for the boll weevil before squaring starts even though they may be present on the cotton.

Overwintered weevils will usually be found near favorable hibernation quarters, such as wooded areas, waste lands, and buildings. Counts may be made by examining all plants on 100 linear feet of row at several different points in each field. Insecticide applications should be made only in areas where as many as one weevil per 100 linear feet of row is found.

The amount of an insecticide applied as either dust or spray for the control of overwintered boll weevils should be from ½ to ¾ of that recommended for later applications. (See tables for control recommendations.)

Mid-Season Control of the Boll Weevil: Begin treatment on high-producing land when 25% of the squares are punctured and on low-producing land when 10% to 15% are punctured. Make applications at 4 or 5-day intervals. *Treat only those areas of the field where the infestation counts show control is needed.* Don't start general treatment until the plants average at least 3 half-grown or larger squares per plant. (See table for control recommendations.)

Late-Season Control of the Boll Weevil: After migration of boll weevils starts, usually about the middle of July in central Louisiana and about August 1 in north Louisiana, make insecticide applications 4 to 5 days apart until the crop is safe. (See tables for control recommendations.)

Thrips

Thrips injury retards growth of seedling cotton, causes a ragging and crinkling of leaves, and in some cases may damage the stand. Cotton outgrows this injury, and there is usually little effect on yield.

Thrips control may be justified because it allows the plants to grow off more rapidly and uniformly, which aids in cultivation. The control of thrips may allow earlier maturity of a part of the crop. In many cases, thrips control has resulted in a slight decrease in final yield. The use of insecticides to control thrips has been followed by damaging infestations of spider mites and the cotton aphid.

In cases where thrips control is desired, an application of insecticides should be made as soon as cotton is up to a stand (two-leaf stage). A second application should be made 7 to 10 days later. Five or six pounds of 3-5-40 mixture or 20-40 mixture may be used to control thrips; or toxaphene may be used as a spray at the rate of 1 pound of technical toxaphene per acre. In cases where aldrin or dieldrin is used, apply ½ of the amount necessary for boll weevil control. (See discussion on aldrin and dieldrin). Insecticides for thrips control can be applied more effectively and economically with ground equipment than by airplane.

Insecticide Formulations

Insecticides for cotton insect control are sold as dust or spray formulations. Dusts are mixed and bagged at the plant and are delivered ready to use. It is not advisable to attempt home mixing of dusts. Sprays for cotton insect control are prepared as emulsifiable concentrates. Water must be added before these are ready to apply. It is always advisable to test an emulsifiable concentrate before applying the spray to be sure it forms a good emulsion when the water is added.

Insecticides Recommended for Controlling Cotton Insects in 1951 Dusts

Calcium Arsenate is an economical and effective insecticide for the control of the boll weevil and cotton leafworm. No other insecticide has been found more effective for the control of the boll weevil. It gives boll protection late in the season superior to any of the organic insecticides tested. When it is used without an aphicide, an increase in the aphid population often results. This can be prevented by using 3-5-40, or calcium arsenate containing 2% nicotine in alternate applications.

3-5-40 Mixture (3% gamma isomer of benzene hexachloride, 5% DDT, and 40% sulfur) will control the boll weevil, cotton aphid, bollworms, cotton leafworm, cotton fleahopper, tarnished plant bug, rapid plant bug, thrips, fall armyworm, cutworms, grasshoppers, and spider mites.

3-10-40 Mixture (3% gamma isomer of benzene hexachloride, 10% DDT, and 40% sulfur) will control the same pests as will the 3-5-40 mixture. The increased amount of DDT gives better control of bollworms. Its use should be limited to situations where heavy bollworm populations are otherwise out of control.

20-40 Mixture (20% toxaphene - 40% sulfur) will control the boll weevil, bollworms, cotton leafworm, cotton fleahopper, tarnished plant bug, rapid plant bug, thrips, cutworms, fall armyworm, grasshoppers and spider mites. It usually will prevent an aphid build-up if used in all applications but will not "knock out" heavy infestations.

DDT will control the bollworm, cotton fleahopper, tarnished plant bug, rapid plant bug, cutworms, fall armyworm, and thrips. Its use alone may be followed by severe cotton aphid and spider mite infestations.

Nicotine, 3% in lime, can be used to knock out heavy aphid infestations.

Sulfur should be included in all organic insecticide mixtures to help prevent the build-up of spider mite infestations.

Sprays

Emulsifiable concentrates of toxaphene and emulsifiable concentrates of DDT are recommended. Spray formulations of these insecticides are as effective as dust formulations if the same amount of technical insecticide is used at the same interval between applications. The expression "technical insecticide" refers to the exact amount of the insecticide itself that is in the mixture.

The amount of technical toxaphene in emulsifiable concentrates will vary from 4 to 8 pounds per gallon. DDT emulsifiable concentrates will usually contain 2 pounds of technical DDT per gallon. The person applying the material must know the actual number of pounds per gallon in order to determine the amount of emulsifiable concentrate to use per acre. The amount of mixed spray emulsion used per acre will vary with the type, make and speed of equipment used.

General Precautions

Most of the insecticides or mixtures recommended for cotton-insect control are poisonous to man and animals. The following suggestions should be followed when handling or using these materials.

1. Study the precautions given on the label. Know what insecticides are being used.
2. Purchase only properly labeled insecticides.
3. Do not open containers or mix insecticides in closed rooms.
4. Avoid the breathing of fumes of dusts or sprays.
5. Wear a recommended respirator when handling or applying these materials.
6. Wear plastic-coated gloves when handling spray concentrates, and wash hands frequently.
7. Store insecticides where they are inaccessible to children and animals.
8. Take bath, using soap freely, and change clothing following exposure to these materials.
9. If liquid concentrates are spilled on the skin or clothing, immediately remove clothing and bathe with soap and water.
10. Certain organic insecticides are highly toxic to fish. Avoid contamination of ponds and streams.
11. Avoid drift of insecticides onto pastures, feed or food crops.
12. Destroy empty containers by burning in the open or burying.

Application of Insecticides

Application of Dusts: All cotton dusts may be applied during either the early morning, late afternoon, or night *when the air is calm.* For effective aphid control, it is necessary that the dusts stay down among the plants and not rise and

(Continued on Page 82)

Conference Report

(Continued from Page 35)

insects for which it is recommeded. The most common commercial dust formulations containing benzene hexachloride used by cotton growers contain 3 percent of the gamma isomer and 5 percent of DDT, with or without sulfur.

A spray formulation containing sufficient technical benzene hexachloride to give 0.3 or 0.4 pound of the gamma isomer plus 0.5 pound of technical DDT per acre has given satisfactory control of the boll weevil and the bollworm. Proper formulation of the emulsion concentrate is necessary to prevent foliage or plant injury.

Benzene hexachloride is toxic to warm-blooded animals. It may enter the body through absorption, inhalation, or ingestion. Proper precautions should therefore be observed in its use.

Grain sorghum, barley, cowpeas, and some other crops are adversely affected by benzene hexachloride. Further research is needed concerning the accumulation of this insecticide in the soil following applications to cotton and the resultant effects on other crops. Until more is known regarding the danger of possible off-flavor in peanuts, Irish potatoes, and some other crops, it is inadvisable to use benzene hexachloride for cotton insect control where the land will later be planted to these crops.

See Hazards and Precautions in the Use of Insecticides.

• **Calcium Arsenate**—Calcium arsenate is an economical and effective insecticide for control of the boll weevil and the cotton leafworm, and has excellent dusting qualities. It is used at the rate of 7 to 10 pounds per acre for boll weevil and cotton leafworm control. Twelve to 15 pounds per acre will control bollworms if applications are properly timed and infestations are not too heavy. It is usually used undiluted against the abovementioned insects. When used without an aphidicide an increase in aphid population often results (see Nicotine.)

Lime-free calcium arsenate is compatible with organic insecticides. When this calcium arsenate is used with parathion (see precautions under Parathion), the boll weevil, the cotton aphid, and spider mites may be effectively controlled. When lime-free calcium arsenate is combined with 5 percent of DDT and 1 percent of parathion, effective control of the boll weevil, the bollworm, the cotton aphid, and spider mites are obtained. Lime-free calcium arsenate in combination with these materials should be applied at the rate of 10 to 12 pounds per acre.

Calcium arsenate in certain light sandy soils is injurious to some crops, especially legumes and oats. It should not be used for cotton insect control in fields where rice may be planted. Drifting of the dust may injure other crops. Precautions should be taken to avoid drift that might cause bee losses. Calcium arsenate is poisonous and should be handled carefully. Livestock should be kept out of dusted fields. Care should be taken to avoid drift onto pastures, especially when applications are made by airplane.

See Hazards and Precautions in the Use of Insecticides.

• **Chlordane**—Chlordane will control the boll weevil, the cotton fleahopper, the tarnished plant bug, grasshoppers, sand wireworms, and thrips. It will not control the bollworm, the cotton aphid, the pink bollworm, and spider mites. Although it kills a high percentage of boll weevils in squares and bolls, the practical benefit derived therefrom has not been demonstrated.

For the insects against which chlordane is effective, from 0.5 to 1.5 pounds of technical material per acre is required.

For over-all cotton insect coatrol, chlordane should always be formulated with DDT and the rate of application should be such that from 1 to 1.5 pounds of technical chlordane and from 0.5 to 0.75 pound of technical DDT per acre will be applied.

The dust formulation generally recommended should contain 10 percent of chlordane plus 5 percent of DDT and should be applied at the rate of 10 to 15 pounds per acre. Sprays should contain 2 parts of chlordane to 1 part of DDT.

These formulations have given excellent results in some areas, while in others the results have been erratic.

The cotton aphid and spider mites may increase to damaging proportions after applications of chlordane-DDT sprays and dusts. Careful inspections for these two pests should be made at weekly intervals after the application of chlordane-DDT formulations; and, if an increase of either species is observed, appropriate measures, as outlined under the respective pests, should be taken to control them.

The toxicity of chlordane to higher animals is greater than that of DDT. Operators should avoid breathing the dust or mist. Contamination of food and feed crops around cotton fields should be avoided.

Little is known regarding possible ill effects on plants from accumulations of chlordane in soils.

See Hazards and Precautions in the Use of Insecticides.

• **DDT**—DDT will effectively control the bollworm, the pink bollworm, the fall armyworm, the tranished plant bug, some species of stink bugs, the rapid plant bug, the cotton fleahopper, and thrips. Unsatisfactory results were reported in some instances when the temperature exceeded 90° F. To a lesser extent it will also control certain species of cutworms. It will not control the boll weevil, the cotton leafworm, spider mites, the cotton aphid, and grasshoppers.

As a dust on cotton, DDT is ordinarily used at concentrations of 5 to 10 percent. It is used either alone or in combination with other insecticides and miticides, and at rates of 10 to 20 pounds per acre. However, not less than 15 pounds per acre of 10 percent DDT should be used for pink bollworm control.

Sprays and dusts containing DDT are about equal in effectiveness against cotton pests. Thorough coverage of the plant and proper timing of applications are more important than the type of formulation used.

Where DDT is used, aphid and mite populations may increase until severe injury occurs unless an aphidicide and a miticide are included in the treatment.

DDT is toxic to certain plants such as cucurbits. Its toxicity persists and accumulates in the soil, and therefore it should be used only in the minimum amounts recommended for cotton insect control, especially on light sandy soils.

In applying DDT, contamination of adjacent crops from drift should be avoided.

DDT is highly toxic to fish and amphibians, and precautions should be taken to avoid the possibility of stream pollution.

Acute toxicity of DDT to man and animals is rather low as compared with the inorganic insecticides now in use on cotton. However, when DDT is repeatedly ingested or brought into contact with the skin it is absorbed and may be stored in the fatty tissues. Injury to liver may also result. Unnecessary exposure of operators should therefore be guarded against.

See Hazards and Precautions in the Use of Insecticides.

• **Dieldrin**—Dieldrin was used experimentally for cotton insect control in many locations throughout the Cotton Belt in 1950. It was effective against the boll weevil when applied at the rate of 0.15 to 0.4 pound per acre. It was effective against thrips, the cotton fleahopper, the tarnished plant bug, the rapid plant bug, the fall armyworm, grasshoppers, and the variegated cutworm when applied at dosages of 0.05 to 0.15 pound per acre. It was not effective at low dosages for bollworm control, and DDT should be added when control of this insect is necessary. Dieldrin will kill newly hatched cotton leafworms at dosages effective against the boll weevil.

Large-scale field experiments, small-scale field tests, and field and laboratory cage tests all indicate that dieldrin is a highly effective insecticide for controlling many of the injurious cotton insects. It is effective either as a dust or a spray.

In some States entomologists may not make general recommendations for the use of dieldrin because of absence of sufficient information relative to the hazards associated with its use under the conditions in their State.

Although not extremely poisonous *acutely*, dieldrin may accumulate in animal tissues and its toxic effects may be delayed for several days or even weeks. It is reported by some investigators to be more poisonous by skin absorption than by ingestion. Its *chronic* effects are not fully determined.

Dieldrin is suggested for use in the control of cotton insects only where persons associated with its application and use are aware of the hazards involved and are supervised by individuals who are in a position to assume full responsibility and enforce the observance of precautionary measures prescribed by the manufacturers.

See Hazards and Precautions in the Use of Insecticides.

• **Heptachlor**—Laboratory and field tests indicate that heptachlor deserves further field evaluation to determine its possible usefulness in the control of cotton insects. In field tests conducted in Texas, Mississippi, and South Carolina during 1950, heptachlor was effective in controlling the boll weevil when applied at the rate of 0.5 to 0.75 pound of the technical material per acre in either dust or spray form. It did not control the bollworm and therefore should be mixed with DDT at the recommended rates whenever it is used for mid-season or late-season boll weevil control. It is not recommended for general boll weevil control, but the 1950 data suggest that it be widely tested in large-scale experiments. Laboratory tests indicate that heptachlor is effective against the variegated cutworm, thrips, and the salt-marsh caterpillar.

Heptachlor did not control the boll-

worm, the cotton leafworm, the cotton aphid, or spider mites.

Heptachlor is more toxic to higher animals than chlordane. Operators should avoid breathing dusts and avoid unnecessary contact with sprays containing this material. Little is known regarding the effect of repeated or prolonged exposure to heptachlor or the possible ill effects on plants from accumulations of it in soils.

See Hazards and Precautions in the Use of Insecticides.

• **Lindane**—Lindane, the essentially pure gamma isomer of benzene hexachloride, may be substituted on an equivalent weight basis for the gamma isomer of benzene hexachloride in formulations of insecticides used on cotton insects.

Lindane is toxic to warm-blooded animals. It may enter the body through absorption, inhalation, or ingestion. Proper precautions should therefore be observed in its use.

See Hazards and Precautions in the Use of Insecticides.

• **Methoxychlor** — Dusts containing 10 percent of methoxychlor controlled the cotton leafworm, but lower concentrations gave poor control.

Methoxychlor gave slightly better pink bollworm control than DDT, but a heavy build-up of aphids usually followed its use and it failed to control bollworms. For these reasons it is not being generally used for pink bollworm control.

Methoxychlor is less effective than the insecticides now recommended for the control of the boll weevil, the bollworm, the cotton aphid, the garden webworm, spider mites, and stink bugs.

Toxicological studies show that methoxychlor is less toxic than DDT to warm-blooded animals and that it is less likely to be stored in the fat or excreted in the milk.

See Hazards and Precautions in the Use of Insecticides.

• **Nicotine**—Two percent of nicotine in alternate applications of calcium arsenate, if properly applied (the period between nicotine applications not to exceed 8 to 10 days), will usually prevent a cotton aphid build-up.

Either 2 or 3 percent of nicotine in a suitable carrier can be used to knock out heavy aphid infestations. At least 0.2 pound per acre of free-nicotine equivalent should be applied. The source may be either nicotine sulfate or a fixed nicotine in dust form.

Applications of nicotine dust to knock out heavy aphid infestations should be applied when the air is calm and preferably when there is no dew on the plants. Complete coverage is essential.

Nicotine is highly toxic to man and animals and should be used with adequate precautions.

See Hazards and Precautions in the Use of Insecticides.

• **Octamethyl Pyrophosphoramide**—This material and related so-called systemic poisons are in preliminary stages of investigation and they are not recommended.

In laboratory tests, octamethyl pyrophosphoramide was translocated by cotton plants when applied to the soils in whcih the plants were growing. A single soil application of 4 to 8 pounds per acre of the technical compound caused the plants to remain toxic to cotton aphids and spider mites for several months. Lower dosages were ineffective. Spray application to foliage of 1 pound of the compound per acre gave aphid and mite protection for 2 to 4 weeks. Cotton seedlings grown from seed treated with 1 pound of octamethyl pyrophosphoramide per 100 pounds of seed were toxic to aphids and mites for 6 weeks. Higher dosages reduced seed germination. Octamethyl pyrophosphoramide was ineffective against the boll weevil, the bollworm, the cotton leafworm, the cotton fleahopper, thrips, and a number of other cotton insects.

Octamethyl pyrophosphoramide is an extremely dangerous poison to man and other animals. In handling it, the same precautions as indicated for parathion should be followed. Until investigations disclose that this material does not persist, cottonseed meal or other cottonseed products from treated plants should not be fed to livestock.

See Hazards and Precautions in the Use of Insecticides.

• **Parathion**—Parathion will control the cotton aphid, spider mites, the garden webworm, and the cotton leafworm. It may be used as a 1-percent dust alone or in combination with other insecticides. It gives very little control of the boll weevil, the bollworm, and the pink bollworm.

Parathion is an extremely dangerous poison. It is not recommended for general use. However, when other suitable insecticides are not available and in other emergency situations, its use on cotton may be justified and recommended where qualified personnel are in a position to assume full responsibility and to enforce

proper precautions as prescribed by the manufacturers.

See Hazards and Precautions in the Use of Insecticides.

• **Rotenone**—Calcium arsenate plus 1 percent of rotenone at each application made against the boll weevil has given satisfactory control of the cotton aphid. For various reasons there may be more occasion for recommending rotenone for cotton aphid control in 1951 than there has been in recent years.

• **Sulfur**—Sulfur has been widely used on cotton for control of spider mites and the cotton fleahopper. When used in dust mixtures it sometimes has a repressive effect upon aphid populations in some areas. Where spider mites are likely to be a serious problem, 40 percent of sulfur or some other suitable miticide should be included in organic insecticide dusts to prevent the development of damaging mite infestations. The supply of sulfur is short for 1951 and it should not be used as a diluent for other insecticides.

• **Tetraethyl Pyrophosphate (TEPP)**—Tetraethyl pyrophosphate, commonly referred to as TEPP, is highly effective as a spray against the cotton fleahopper, the cotton aphid, and spider mites when used on dry plants. Experiments indicate that applications containing 0.5 pint of 40 percent tetraethyl pyrophosphate, or its equivalent, per acre effectively control heavy populations of these pests.

Tetraethyl pyrophosphate is an extremely dangerous poison. It is recommended for use on cotton only where a qualified person is in a position to assume full responsibility and to enforce proper precautions as prescribed by the manufacturers. It deteriorates very rapidly when exposed to moisture or moist air and is incompatible with alkaline materials. The residual toxicity of this chemical is very short.

See Hazards and Precautions in the Use of Insecticides.

• **Toxaphene** — Toxaphene will control the boll weevil, the bollworm, the fall armyworm, the tranished plant bug, the rapid plant bug, the cotton leafworm, cutworms, and grasshoppers when applied at the rate of 2 to 3 pounds of the technical material per acre. It will also control the cotton fleahopper and thrips when applied at the rate of 0.75 to 1 pound of the technical material per acre. Experiments show that dusts and sprays are equally effective in most areas when properly applied.

Bollworm control was improved where DDT was incorporated in the toxaphene spray mixture. Toxaphene alone will not give satisfactory control of the pink bollworm.

Where toxaphene was used throughout the season satisfactory suppression of the cotton aphid resulted. It will not, however, control heavy aphid infestations. It will not control spider mites, and its use may result in their increase; therefore, in some areas it is recommended that the dust contain at least 40 percent of sulfur or some suitable miticide.

No economic injury to cotton has been reported from the use of toxaphene. This material can be handled with relative safety to the operator if proper precautions are taken. Toxaphene is toxic to livestock and poultry, and is very toxic to fish.

See Hazards and Precautions in the Use of Insecticides.

Cultural Practices Aid in the Control of Cotton Insects

Certain cultural practices reduce cotton losses from insect pests and often reduce and may eliminate the need for insecticides. The use of such practices should be encouraged. This is especially important when insecticides are in short supply. Several of the following practices may be used by any cotton grower. Others are applicable to certain areas and conditions only. Growers should, in addition to following these practices, continue to make careful observations for insects and apply insecticides when needed.

• **Planting**—Reasonably early planting of all cotton within an area during a short period enables the crop to produce maximum growth and fruit before insects multiply and spread from field to field.

• **Varieties**—Prolific varieties of cotton that fruit early and mature quickly may set a crop before the boll weevil and other insects become numerous, especially if other cultural controls are used.

• **Soil Improvement**—More injury from insects, without yield reduction, can be tolerated by rapid-growing cotton in rich soil than by cotton growing in poor soil. For this reason, practices such as fertilization, rotation of crops, and plowing under of green manure tend to offset insect losses.

• **Other Host Crops of Cotton Pests** — Cotton fields should be located as far as is practicable from other host plants of cotton insects. Thrips breed in onions, potatoes, carrots, and some other crops and later move in great numbers into adjacent or interplanted cotton. Garden webworms and variegated cutworms and Lygus bugs may migrate to cotton from alfalfa. The cotton fleahopper migrates from croton and other weeds.

• **Hibernation Areas**—Boll weevils hibernate during the winter in well-drained, protected areas in and near cotton fields. Spider mites hibernate in low-growing perennials in or near fields. Clean cultivation reduces weevil hibertion quarters. Planting of winter cover crops to improve the soil and prevent erosion is recommended. Small patches of weeds near fields, along turnrows and fences, or around stumps and scattered weeds in cultivated fields or pastures can be destroyed at a small cost. Such practices are more effective where the cotton acreages are in sizeable blocks rather than in small patches. The general burning over of woods is not recommended.

• **Early Stalk Destruction**—The destruction or killing of cotton plants by either mechanical or chemical methods, as early as possible before the first killing frost, forces boll weevils into starvation before they go into winter quarters. The result of early stalk destruction, especially over community- or county-wide areas, has greatly reduced the boll weevil problem in the Lower Rio Grande Valley and in other parts of Texas. This practice is also recognized as important in pink bollworm control in most areas. Plowing under the crop residue as deeply as possible after the stalks are cut will also reduce the survival of the pink bollworm.

Legumes in Relation to Cotton Insect Control

It is recognized that soil-building and soil-conserving leguminous crops are fundamental in a cotton-growing program. It is further recognized that a number of insects that attack legumes later transfer to cotton, thereby increasing the cotton insect problems. This situation may have a tendency to, but definitely should not, discourage the use of legumes. Entomologists should give serious consideration to insect control for the protection of both legumes and cotton.

Bug-Catching Machines

Bug-catching machines are not recommended as a means of controlling cotton insects.

Cotton Insects

• **Boll Weevil**—The boll weevil, *Anthonomus grandis* Boh., may be effectively controlled with benzene hexachloride, calcium arsenate, toxaphene, aldrin, and dieldrin. Benzene hexachloride should be applied at a rate of not less than 0.3 pound of the gamma isomer per acre, calcium arsenate at 7 to 10 pounds per acre, toxaphene at 2 to 3 pounds of the technical material per acre, aldrin at 0.25 to 0.5 pound of the technical material per acre, and dieldrin at 0.15 to 0.4 pound of the technical material per acre. When these insecticides are used for boll weevil control under field conditions, other insect problems have to be considered. Infestations of the cotton aphid, the bollworm, and spider mites may develop when some of these insecticides are used alone.

The following dusts have been approved for use in areas where recommended:

1. Benzene hexachloride to give 3 percent of the gamma isomer in the finished dust plus 5 percent of DDT (sometimes referred to as "3-5-0").
2. Calcium arsenate applied alternately with calcium arsenate plus 2 percent of nicotine.
3. Calcium arsenate applied alternately with a mixture of benzene hexachloride (3 percent gamma isomer) and 5 percent of DDT.
4. Lime-free calcium arsenate plus 1 percent of parathion.
5. Lime-free calcium arsenate plus 1 percent of parathion and 5 percent of DDT.
6. Toxaphene 20 percent.
7. Aldrin 2.5 percent.
8. Aldrin 2.5 percent plus 5 percent of DDT.
9. Diledrin 1.5 or 2.5 percent.
10. Dieldrin 1.5 or 2.5 percent plus 5 percent of DDT.
11. Chlordane 10 percent plus 5 percent of DDT. (This mixture is recommended only in areas where it has given good control. It has given erratic results in some areas, perhaps because of high temperatures and humidity.)

In areas where spider mites are a problem, dust formulations of organic insecticides should contain sulfur or some other suitable miticide.

The following treatments with sprays made from emulsion concentrates have given favorable results and are approved where recommended:

1. Toxaphene at the rate of 2 to 3 pounds of the technical material per acre.
2. Toxaphene and DDT in the ratio of 2 to 1 applied at the rate of 2 to 3 pounds of technical toxaphene per acre.
3. A mixture to give 0.3 to 0.5 pound

of the gamma isomer of benzene hexachloride and 0.5 pound or more of technical DDT per acre.

4. Aldrin at the rate of 0.25 to 0.5 pound of the technical material per acre.
5. A mixture to give 0.25 to 0.5 pound of technical aldrin and 0.5 pound or more of technical DDT per acre.
6. Dieldrin at the rate of 0.15 to 0.4 pound of technical material per acre.
7. A mixture to give 0.15 to 0.4 pound of technical dieldrin and 0.5 pound or more of technical DDT per acre. In areas where it has proved satisfactory and where it is recommended, a mixture of 1 pound of technical chlordane and 0.5 pound or more of technical DDT per acre may be used.

Control measures directed against the boll weevil should be applied when definite need is indicated. Except where early season control measures are practiced, insecticides should be applied at intervals of 4 to 5 days until the infestation is brought under control. Thereafter, the fields should be inspected weekly and applications made when necessary.

• **Bollworms**—At least four species of lepidopterous larvae damage cotton bolls. The most important are the bollworm, *Heliothis armigera* (Hbn.), and the tobacco budworm, *H. virescens* (F.).

During the past two years the tobacco budworm has been the predominant species early in the season in many collections of bollworms from cotton, particularly in the eastern part of the Cotton Belt. The yellow-striped armyworm, *Prodenia ornithogalli* Guen., and fall armyworm, *Laphygma frugiperda* (A. & S.), are the others that sometimes cause bollworm injury.

It is often a difficult task to control this group of insects and many erratic results have been reported. Factors which contribute to their abundance are sometimes complex and not too well known. The widespread use of certain of the organic insecticides has often resulted in greatly increased bollworm damage, presumably as a result of killing off the natural enemies. Probably, also, changing farm practices due to diversification and mechanization have resulted in conditions more favorable for the normal increase of these insects.

Effective bollworm control depends on the use of properly formulated insecticides and timeliness and thoroughness of application. Frequent field inspections during the main fruiting period of cotton in any given field to determine the presence of eggs and young larvae are prerequisite to satisfactory bollworm control. After the larvae have already entered the squares and bolls it is too late for effective control.

DDT is the most effective insecticide known for the control of bollworms. It should be applied at the rate of 1 to 1.5 pounds of the technical material per acre in the form of a 10 percent dust or as a concentrated spray. DDT may be used in mixtures with other insecticides where other insects as well as bollworms require control. It is compatible with lime-free calcium arsenate but not with regular calcium arsenate. Where 0.5 pound or more of DDT per acre is applied with other insecticides in the regular schedule for boll weevil control, bollworms are usually controlled.

Toxaphene, at the rate of 2 to 3 pounds per acre, is the next most effective insecticide against bollworms. This may be applied as a 20 percent dust or as a spray. The dust appears to be more effective than the spray, and for this reason the spray is often formulated to contain DDT.

Calcium arsenate and cryolite dusts are less effective.

In areas were spider mites are a problem, dust mixtures containing organic insecticides used for the control of bollworms should include 40 percent of sulfur or some other suitable miticide.

• **Cotton Aphid**—Heavy infestations of the cotton aphid, *Aphis gossypii* Glov., often occur on cotton after the use of certain insecticides. Infestations may also be severe on seedling cotton where no insecticides have been applied.

The following treatments, which are recommended for general use in cotton insect control, will usually prevent an aphid build-up:

1. A mixture containing 3 percent of the gamma isomer of benzene hexachloride and 5 percent of DDT in every application at the rate of 10 to 12 pounds per acre.
2. A mixture containing 3 percent of the gamma isomer of benzene hexachloride and 5 percent of DDT at the rate of 10 to 12 pounds per acre in alternate applications with calcium arsenate.
3. Nicotine 2 percent in regular calcium arsenate at the rate of 10 to 12 pounds per acre alternated with calcium arsenate alone.
4. Parathion 1 percent in lime-free calcium arsenate at the rate of 10 pounds per acre.
5. Toxaphene at the rate of 2 to 3

pounds of the technical material per acre in every application (where toxaphene is not formulated with DDT).

When heavy infestations of the cotton aphid occur and where the need for rapid kill is indicated, the following treatments are effective:

1. Benzene hexachloride applied to give 0.5 pound of the gamma isomer or an equivalent amount of lindane per acre.
2. A 1-percent parathion dust applied at the rate of 12 to 15 pounds per acre.
3. Nicotine 3 percent in hydrated lime applied at the rate of 10 to 15 pounds per acre.

Another insecticide which will give quick control of heavy infestations of the cotton aphid, but which is not generally recommended because of its toxicity and low residual action, is 0.5 pint of 40 percent tetraethyl pyrophosphate, or its equivalent, per acre.

• **Cotton Fleahopper**—The cotton fleahopper, *Psallus seriatus* (Reut.), can be controlled with the following dusts: DDT 5 percent, toxaphene 10 percent, dieldrin 1.5 percent, aldrin 2.5 percent, benzene hexachloride (gamma isomer 1 percent), and chlordane 2 percent. When spider mites are likely to be a problem, 40 percent or more of sulfur or a suitable miticide should be added to organic insecticide formulations. Less effective control of the cotton fleahopper may be obtained with sulfur alone or with a 1:1 or 2:1 mixture of calcium arsenate and sulfur.

The following materials applied as low-gallonage sprays at the rates indicated per acre will give good control of the cotton fleahopper: 0.5 pound of DDT, 1 pound of toxaphene, 0.5 pound of toxaphene plus 0.25 pound of DDT, 0.1 pound of dieldrin, 0.2 pound of aldrin or 0.5 pint of 40 percent tetraethyl pyrophosphate.

In some instances cotton aphids develop after the use of DDT dust or spray.

• **Cotton Leafworm** — The cotton leafworm, *Alabama argillacea* (Hbn.), has been controlled successfully for many years by calcium arsenate, paris green, or lead arsenate. Dust and spray formulations of benzene hexachloride, toxaphene, a mixture of benzene hexachloride and DDT, or a mixture of toxaphene and DDT are effective in controlling the cotton leafworm.

• **Cutworms**—Cutworm outbreaks may develop in weeds or crops, especially legumes. Cutworms migrate to adjacent cotton or attack cotton planted on land previously in weeds or legumes.

Recommended control measures are thorough seed-bed preparation and use of insecticides. Allow at least three weeks to elapse between the time of plowing under an infested area and the subsequent seeding of the cotton crop. Toxaphene or dieldrin sprays and dusts as recommended for boll weevil control are effective. Poison baits containing paris green, sodium fluosilicate, or toxaphene have been found satisfactory. A poison bait consisting of 40 percent of cryolite and 60 percent of citrus meal gives effective control.

• **Fall Armyworm**—The fall armyworm, *Laphygma frugiperda* (A. & S.), occasionally occurs in sufficient numbers to damage cotton. The following dusts have given good control: Toxaphene 20 percent; sufficient benzene hexachloride to give 3 percent of the gamma isomer plus 5 percent of DDT plus 40 percent of sulfur (commonly known as 3-5-40); chlordane 10 percent; or DDT 10 to 20 percent. A 5-percent DDT dust will control small worms. These dusts should be applied at the rate of 20 pounds per acre. Toxaphene or DDT as sprays applied at the rate of 2 pounds of technical material per acre have also given good control. The results obtained from the above materials have varied in different States; therefore local recommendations are advisable. (Also see Bollworms.)

• **Garden Webworm**—The garden webworm, *Loxostege similalis* (Guen.), may be controlled on cotton by dusts containing 5 percent of DDT plus sufficient benzene hexachloride to give 3 percent of the gamma isomer, 20 percent of toxaphene, or 10 percent of DDT. DDT has given better control in sprays than in dusts and is generally less effective than the other two materials. Calcium arsenate may also be used to control the garden webworm, but heavy poundages are required and control is generally less satisfactory than with the new organic insecticides.

• **Grasshoppers** — Several species of grasshoppers, particularly *Melanoplus differentialis* (Thos.) and *Schistocerca americana* (Drury), attack cotton. The adults of *S. americana* hibernate and deposit their eggs in the fields, but most of the other species overwinter as eggs in untilled soil in fence rows, sod waterways, around stumps, and in similar locations. The latter can best be controlled by early treatment of hatching beds before the grasshoppers migrate into the fields. Sprays or dusts containing aldrin, chlordane, dieldrin, toxaphene, or benzene hexachloride are rapidly replacing poison baits for grasshopper control in many areas. This is particularly true where grasshoppers must be controlled on lush or dense vegetation.

Benzene hexachloride sprays and dusts usually produce a spectacular kill of the grasshoppers in a few hours, but results have been erratic and residual effectiveness is limited to 1 or 2 days. Aldrin, chlordane, dieldrin, and toxaphene are very effective but are slower in their action. They remain residually effective for 5 to 14 days, however, depending on prevailing environmental conditions.

Dosages suggested to control grasshoppers fall within the following ranges:

	Pounds per acre
Aldrin	0.1 -0.25
Benzene hexachloride, gamma isomer	0.3 -0.5
Chlordane	0.5 -1.5
Dieldrin	0.07-0.125
Toxaphene	1.0 -2.5

The lowest dosage rates suggested are effective against newly hatched to half-grown grasshoppers. The dosage should be increased as the grasshoppers mature or when the materials are applied on partly defoliated plants or on plants that are unpalatable to the insects.

Baits made according to State and Federal recommendations still have a place in grasshopper control where treatment of extensive areas is required, particularly in sparse vegetation.

• **Pink Bollworm**—Methods of controlling the pink bollworm, *Pectinophora gossypiella* (Saund.), include destruction of cotton stalks immediately after the harvest, heat treatment of cottonseed, burning of gin waste, compression of lint, and the application of dust and spray formulations. In South Texas pink bollworm infestations early in any season are in proportion to the number of these insects that survive the period between crops. The longer this period the fewer insects will survive; therefore, the number of overwintering insects may be reduced by destroying cotton stalks at the earliest possible date. The best procedure is to cut the stalks with a stalk cutter which crushes them to the ground. If this operation is carried out sufficiently early a high mortality of pink bollworms and other cotton insects results from exposure to heat of the sun. The roots should be plowed out promptly and the crop debris plowed under. All seedlings or sprouted cotton plants developing after the plowing should be eliminated before fruiting so as to create a long host-free period between crops. For best results cultural practices should be carried out on an area-wide basis and the cooperation of every cotton grower is needed. Cultural practices used to control the pink bollworm will also control the boll weevil.

Cotton growers of the Lower Rio Grande Valley of Texas have used the cultural method of control outlined above and, over a 5-year period, lint production averaged 342 pounds per acre. Over a 5-year period prior to the beginning of control by early stalk destruction, lint production there averaged 213 pounds per acre. This increase in yield at current prices amounted to around $17,000,000 for the 1950 crop from about 375,000 acres. The increased production resulted largely from boll weevil control and greater productivity of the soil because of improved farming methods.

There is a progressive build-up in the pink bollworm population as the season advances; therefore, every effort should be made to expedite fruiting and setting the crop. The following practices are recommended for hastening the maturity of the cotton and thereby reducing the pink bollworm infestation: Heat or chemical treatment of planting seed; early uniform planting of quick-maturing varieties; control of cotton fleahoppers, thrips, aphids, and other insects that delay fruiting; clean cultivation; elimination of late irrigation; and chemical defoliation.

In cold, arid regions, such as the West Texas Area where the harvest must be completed after frost, as many bolls as possible should be removed by snapping, mechanical harvesting, or by heavy pasturing. The cotton stalks should be left standing during the winter months, since the highest mortality of hibernating pink bollworm larvae in such areas is obtained in the bolls on standing stalks. Where the stalks are plowed under early in the winter the fields should be winter irrigated wherever possible.

Larvae of the pink bollworm enter mature cottonseeds to feed and to hibernate. To prevent the overwintering or spread of the insect, cottonseed are given a heat treatment as a continuous process of ginning in much of the pink bollworm quarantined area. In the remainder of the area, cottonseed are heat-treated upon arrival at designated oil mills or other treating plants. In the heavily infested areas a second heat treatment is required before movement into other quarantined or free areas. In all pink bollworm quarantined areas gin

waste is destroyed promptly by burning, or heat-treated for use as fertilizer, and all lint is compressed before it is moved into areas that are free of pink bollworm.

DDT continues to be the best insecticide for control of the pink bollworm. It can be applied as a dust or as an emulsion spray. From 1.5 to 2 pounds of technical DDT should be used per acre application. Dust formulations containing 10 percent of DDT should be applied at the rate of 15 pounds per acre. Large-scale demonstration tests, with applications beginning when the cotton is in the 6- to 8-leaf stage, have proved highly effective when followed with later applications as required by infestation conditions of pink bollworms and other insects. These early applications are especially beneficial in shortening the fruiting period. The result is that fewer generations of pink bollworms develop and early stalk destruction is possible. The number of hibernating pink bollworms is thus reduced.

Aphids and spider mites may develop when DDT is used alone for pink bollworm control. Benzene hexachloride and sulfur or parathion may be added to the dust formulations and TEPP may be added to the spray formulations for control of these pests as recommended.

Regardless of the other insects to be controlled, all formulations for control of the pink bollworm should contain sufficient DDT to give the minimum of 1.5 pounds of technical DDT per application per acre irrespective of the other materials or the spacing of applications.

Farmers, county agents, ginners, and all others in the cotton industry should cooperate fully with State and Federal quarantine agencies in preventing spread of the pink bollworm, especially with regard to the movement of cotton seed from infested areas.

• **Spider Mites** — Although several species of spider mites are known to attack cotton, two are believed to be of greatest importance as cotton pests—the two-spotted spider mite, *Tetranychus bimaculatus* Harvey, and a recently described species from Texas, *Septanychus texazona* McG.

It is known that the use of certain of the organic insecticides for cotton insect control has resulted in serious spider mite infestations.

Sulfur has been the standard recommendation for the control of spider mites for many years, and satisfactory results have usually been obtained from its use. For the control of local incipient infestations, it should be applied at the rate of 20 to 25 pounds per acre.

In some areas organic insecticide dusts for use on cotton are formulated to contain at least 40 percent of properly conditioned dusting sulfur or some other suitable miticide. The use of such formulations has usually prevented damage from spider mites and is recommended.

Dust containing 1 percent of parathion applied at the rate of 10 to 12 pounds per acre is also highly effective against spider mites on cotton.

TEPP at the rate of 0.5 pint of the 40 percent concentrate, or its equivalent, per acre effectively controls heavy populations.

When the organic insecticides are applied as low-gallonage sprays, elemental sulfur cannot be incorporated in the spray formulations. When sprays are being used and the mite population begins to noticeably increase, Aramite, the active ingredient of which is 2-(*p*-tert.-butylphenoxy)-1-methylethyl 2-chloroethyl sulfite, also known as 88R, may be added to the next spray application at the rate of 0.33 pound per acre for rapid and effective control.

Three other new compounds were tested under field conditions during 1950 and appear sufficiently promising to justify recommending for large-scale experimental use during 1951 to bring about rapid and effective control. They are as follows: (1) R-242, also called technical *p*-chlorophenyl phenyl sulfone, at the rate of 1 to 1.5 pounds per acre; (2) 923, also called technical 2, 4 dichlorophenyl ester benzene sulfonic acid, at the rate of 1.5 to 2 pounds per acre; (3) K-6451, also called technical *p*-chlorophenyl *p*-chlorobenzene sulfonate, at the rate of 1.5 to 2 pounds per acre.

Laboratory tests indicate that *S. texazona* is more susceptible to certain miticides than is *T. bimaculatus*. Where the latter species occurs, it may be necessary to increase the amounts of the chemicals mentioned.

Overwintering infestations of spider mites survive on low-growing perennials. These can be destroyed by winter cultivation, giving particular attention to normally uncultivated spots around stumps and along margins of fields. Such practices aid in controlling outbreaks.

• **Tarnished Plant Bug, Rapid Plant Bug, and Related Species** — The tarnished plant bug, *Lygus oblineatus* (Say), the rapid plant bug, *Adelphocoris rapidus* (Say), and related species such as *Creontiades debilis* (Van D.) and *Neurocolpus nubilus* (Say) often cause injury to cotton. The organic insecticides recommended for boll weevil or bollworm control are effective against these plant bugs.

• **Thrips**—Thrips often cause more injury to cotton seedlings than is generally realized, especially in areas where onions and small grains are grown extensively. The destruction of leaf tissue by thrips and the subsequent slow plant growth make the seedling more susceptible to injury by such fungus diseases as the Ascochyta blight and Rizoctonia damping-off. The combined injury may reduce or even destroy stands of young plants. A heavy thrips infestation will retard plant growth and delay crop maturity. Although reductions in yield may not result, the subsequent delay in crop maturity may lower the quality of seed and lint because of the greater likelihood of damage by insects and deterioration associated with unfavorable weather conditions.

A number of insecticides give satisfactory thrips control when properly applied. Toxaphene at the rate of 0.5 to 1 pound per acre, in either dust or spray form, gives effective control. A spray mixture consisting of 0.66 pound of toxaphene and 0.33 pound of DDT per acre or a dust mixture containing 5 percent of DDT and sufficient benzene hexachloride to give 1 percent of the gamma isomer applied at the rate of 12 to 15 pounds per acre is also effective.

Aldrin applied to young seedlings as a spray or dust at the rate of 0.08 to 0.125 pound per acre gives good thrips control. Dieldrin applied at the rate of 0.05 to 0.1 pound per acre is very effective.

Other insecticides which give satisfactory control either as a spray or a dust at indicated rates per acre are chlordane 0.5 to 1 pound, benzene hexachloride 0.1 to 0.15 pound, heptachlor 0.25 to 0.5 pound, and DDT 0.25 to 0.5 pound. DDT has not given satisfactory control at temperatures above 90° F.

Although some of the phosphate compounds are effective against thrips, they are extremely poisonous and must be handled with great care.

• **Tobacco Budworm**—See Bollworms.

• **White-Fringed Beetles** — The white-fringed beetles, *Graphognathus leucoloma* (Boh.), *G. peregrinus* (Buch.), and *G. minor* (Buch.), which are pests of cotton and many other farm crops, are known to be present in limited areas of Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee.

Larvae of the white-fringed beetles damage cotton by feeding on the roots of young plants. These insects can be controlled by the use of good cultural practices and insecticides. Good cultural practices recommended include the following:

1. Plant oats or other small grains in heavily infested areas.
2. Restrict planting of summer legumes, such as peanuts, soybeans, velvet beans, or other favorable host plants of the adult beetles to not more than one-fourth of the total crop land. Do not plant these crops on the same land more often than once in 3 or 4 years.
3. Do not intercrop corn with peanuts, soybeans, crotalaria, or velvet beans. Prevent the growth of broadleaved weeds, such as cocklebur and sicklepod.
4. Improve poorer soils by turning under winter cover crops.

DDT is effective as a soil insecticide for control of white-fringed beetle larvae. Apply 50-percent DDT at the rate of 20 pounds per acre or 25-percent DDT at the rate of 40 pounds per acre evenly to the soil surface as a dust, spray, or mixed with sand, and then thoroughly mix it into the upper 3 to 4 inches of soil. This treatment will give control of larvae for at least 5 years. DDT may be used in the drill before planting. Use 50-percent DDT at the rate of 5 to 10 pounds per acre, or 25-percent DDT at the rate of 10 to 20 pounds per acre, mixed with sand. This may be applied by hand or by a fertilizer distributor, at or slightly below the depth of seed planting.

Either toxaphene or a benzene hexachloride-DDT mixture applied on cotton foliage gives a residue in the soil, which aids in the control of white-fringed beetles. These insecticides should be used for the control of those cotton insects for which they are recommended in white-fringed beetle infested areas.

• **Wireworms**—Several species of wireworms are associated with cotton. Perhaps the most noticeable damage is caused by the sand wireworm, *Horistonotus uhlerii* Horn., in South Carolina, Louisiana, and Arkansas. Adults of the tobacco wireworm (spotted click beetle), *Conoderus vespertinus* (F.), are frequently found on the cotton plant, but the amount of damage to cotton caused by the larvae of this species is not known.

Approved crop rotation practices, increased soil fertility, and added humus help to reduce damage to cotton caused by the sand wireworm. Chlordane, DDT, lindane, and benzene hexachloride have shown promise in the control of this and other species of wireworms on other

crops. Additional research on the control of wireworms attacking cotton is needed.

• **Yellow-Striped Armyworm**—See Bollworms.

Insects That Attack Cottonseed in Storage

Cottonseed rarely becomes infested with insects while in storage, if proper precautions are followed. Cottonseed or seed cotton should be stored only in a bin or room that has been thoroughly cleaned of all old cottonseed, grain, hay, or other similar products in which insects that attack stored products are likely to develop. Among the insects that cause damage to stored cottonseed or to cottonseed meal are the cigarette beetle, *Lasioderma serricorne* (F.), the Mediterranean flour moth, *Ephestia kuhniella* Zell., and the Indian-meal moth, *Plodia interpunctella* (Hbn.). Cottonseed that is to be used for planting only may be dusted with toxaphene before being placed in storage. Seed so treated should not be crushed or used for feed.

Parasites and Predators of Cotton Insects

Parasites and predators aid greatly in the control of insect pests of cotton. However, their help cannot always be relied upon and it is usually necessary to use cultural control practices and to spray or dust the cotton with insecticides. Extensive investigations, which have included the importation and colonization in cotton fields of several insect parasites of the pink bollworm, have shown that so far the use of these natural enemies of cotton insects has limitations.

Cotton Insect Surveys

The importance of surveys to an overall cotton insect control program has been clearly demonstrated during the last few years. Cotton insect surveys conducted on a cooperative basis by State and Federal agencies in most of the major cotton-growing States have developed into a broad, currently advisory service for the guidance of the farmer, others associated with cotton production, and the industry that serves the farmers by supplying insecticidal chemicals. As a result of survey work, farmers are forewarned of the insect situation and losses are materially reduced below what they would be without the information thus gained. The survey also helps to direct insecticides to areas where supplies are critically needed.

More people are being employed each year by business firms, individual farm operators, and others interested in cotton production to determine cotton insect populations. It is important that individuals employed by private interests to make surveys understand the control programs as well as how to make infestation counts. Therefore, State and Federal entomologists should assist in locating personnel that have at least some basic training in entomology to do survey work for private interests. If this is not done, many growers are sure to be misinformed about recommended control practices.

Information obtained through surveys on insect populations has done much to create interest in cotton insect control programs. When survey data are collected, interpreted, and disseminated at weekly intervals, it is helpful to growers, the insecticide industry, entomologists, and all others interested in an effective control program. The extent and intensity of the coverage largely determine the value of surveys. It is the type of service that can be supplied only through leadership and cooperative undertaking. Therefore, it is recommended that cotton insect surveys be continued, that they be placed on a permanent basis, and that they be expanded to include all cotton-producing States.

Wherever possible, it is well to enlist and train voluntary cooperators to make field observations and records and to submit reports during the active season. Wider dissemination of the information that is compiled is highly desirable.

NCPA Rules Proposal Deadline Is April 7

Proposed changes in the rules of the National Cottonseed Products Association must be submitted to the secretary in proper form at least 30 days prior to the annual convention of the association, which will be held May 14, 15 and 16, Secretary-Treasurer S. M. Harmon has reminded members.

Mr. Harmon suggested that proposed changes be sent to his office so as to arrive not later than April 7.

The Rules Committee of the association will meet at 4 p.m. Friday, May 11, in the Coral Room of the Palm Beach Biltmore Hotel, Palm Beach, Fla., where the convention will be held. If necessary, sessions of the committee will meet that evening and on Saturday, May 12.

Wins Dallas Civic Award

JOHN E. MITCHELL, JR., president of John E. Mitchell Company, Dallas, manufacturers of cotton gin machinery, last week received the Linz Service Award, top annual civic award in Dallas. Mr. Mitchell has been very active in Dallas civic activities for many years and has done notable work with the Dallas Community Chest. In 1947 he was the Chest's general campaign chairman. In 1948 he was chairman of the budget committee and served as president of the Chest in 1949. In 1950 he served as chairman of the executive committee and is still a member of that committee. He is an honorary life member of the Chest's board of directors.

NCPA Educational Service Articles Widely Used

Feeding articiles prepared and distributed by the Educational Service of the National Cottonseed Products Association have been published in February issues of a number of leading publications.

"The Cattleman," in the Southwest, "Livestock Weekly," in the Mid-South area, "The Hereford Journal" and "Oklahoma Cotton Grower" are among publications using the articles in current issues. The Florida Extension Service has distributed a release to newspapers of that state based upon Educational Service material.

Garlon A. Harper, assistant in nutrition, contributed two livestock articles to the March issue of "Farm and Ranch-Southern Agriculturist."

South Africa Permits Margarine Expansion

Union of South Africa's ceiling on the annual quantity of margarine that may be manufactured has been recently raised to 18 million pounds, according to Joseph L. Dougherty, agricultural attache, American Embassy, Pretoria.

This maximum, a 50 percent increase from the former level of 12 million pounds, was established in the Dairy Industry Control Amendment Act of 1950 passed by the Union Parliament on June 22.

Council Opens Beltwide Insect Control Drive

Listing control of boll weevil and other cotton pests as one of the key objectives in the cotton industry's effort to obtain a 16-million-bale cotton crop in 1951, the National Cotton Council has opened a Beltwide campaign to reduce cotton insect losses.

Claude L. Welch, director of the Council's production and marketing division, said the campaign is part of an integrated cotton insect control effort in which the cotton industry, state and federal agencies, and other interests are cooperating.

"A sound insect control program offers the individual cotton farmer one of his best opportunities for higher yields and greater profits," the Council staff member stressed.

"More than that," he added, "such a program when carried out on a Beltwide scale, in which everyone is cooperating, will greatly enhance the chances of obtaining the 16 million bales of cotton.

"There is going to be a vital need for obtaining the highest production possible on every acre planted to cotton. The desired yields can be achieved only through following the most efficient production practices, of which insect control is one of the most important."

California Seeks Filipino Farm Workers for 1951

Like most of the cotton states, California is wrestling with the problem of how it is going to harvest the 1951 cotton crop. It is estimated that 1,250,000 acres will be planted to cotton in California this year.

The state department of employment estimates the demand for labor will be 38 to 40 percent above the wartime year of 1944. The state board of agriculture, which has been studying the labor problem, has already taken action to speed up the recruitment of Filipinos in the Hawaiian Islands for farm jobs in the state. The state employment department said the importation of 40,000 Mexican farm workers, which now appears probable, still will leave a gap of 35,000 between supply and demand.

It is estimated that California may have as many as 1,500 more mechanical cotton pickers this year, but the need for hand pickers, because of the great increase in acreage, will be as great or greater than ever.

Georgia Plans 1951 5-Acre Cotton Contest

Plans for the 1951 5-Acre Cotton Contest in Georgia have been announced by E. C. Westbrook, Extension Service cotton specialist.

Sponsored by the Georgia Cottonseed Crushers Association, the contest offers a $500 prize to the state champion, $250 prizes to each of six district champions, $150 to second place district winners and $100 to third place winners in the districts.

The Atlantic Cotton Association is offering a $500 bonus prize this year to the farmer who exceeds the highest yield made in the contest since it began in 1947. The previous high yield was the three bales per acre average produced by W. A. Meadows, Bleckley County, in 1949.

Brannan Announces USDA Reorganization

Secretary of Agriculture Charles F. Brannan has announced the reorganization of the soil conservation and agricultural research activities of the U. S. Department of Agriculture and the reorientation of its staff and administrative structure for defense mobilization purposes. Three memoranda were issued for this purpose.

County offices of USDA dealing with conservation will be consolidated, and arrangements will be made to maintain these offices open to the public on Saturdays. A similar move to consolidate state offices has also been directed. The actions become effective immediately. Secretary Brannan stated that the reorganization is to be accomplished by using the existing powers of the Secretary and do not depend upon additional legislation.

The contents of the three memoranda are:

(1) Coordination of agricultural resources conservation services. A single policy will govern the soil conservation activities of the USDA, and the activities will be carried out through a unified and interlocking administrative organization.

(2) Coordination of Agricultural Research Services. All research activities of USDA are placed under the supervision of an assistant secretary for the first time.

(3) Reorientation of department agencies for agricultural mobilization purposes. The Secretary established the following: (a) a National Agricultural Mobilization Committee, (b) an agricultural Mobilization Policy Board, (c) a state Agricultural Mobilization Committee, (d) a county Agricultural Mobilization Committee.

Fire Destroys Seed House At Thorndale Mill

A fire which burned for five hours before it was brought under control destroyed a steel seed house filled with cottonseed at the Cen-Tex Cooperative Oil Mill, Thorndale, Texas, on Feb. 28.

W. R. Sanders, manager, estimated the loss at more than $200,000, excluding the cost of the house, which was built two years ago at a cost of $80,000.

Texas Cotton Association To Meet March 23-24

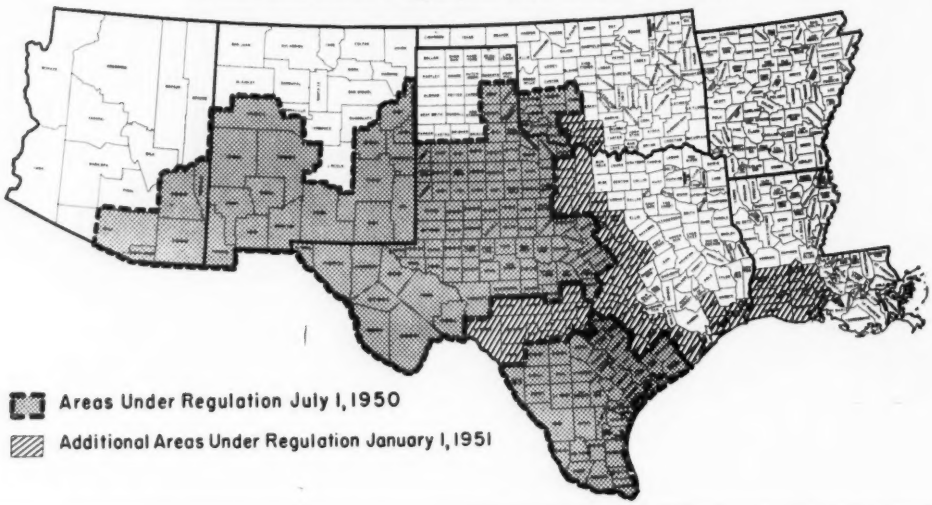
The fortieth annual convention of the Texas Cotton Association will be held in Dallas March 23-24, with headquarters at the Baker Hotel.

Social program announced for the meeting will include a stag luncheon and a ladies' luncheon March 23. A cocktail party and dinner dance will be given that night.

Pakistan Increases Sesame Acreage

Pakistan's sesame acreage for 1950-51 is placed at 193,000 acres, according to the second estimate reported to USDA. This is a 4.9 percent increase over the corresponding forecast of 184,000 acres in 1949-50. Included in this is the area damaged or destroyed by excessive rains and heavy floods in the Punjab, which amounts to 8,000 acres and represents 27 percent of the sesame area in the Punjab.

Pink Bollworm Regulated Areas, Jan. 1, 1951



Circular on Cottonseed Meal as Poultry Feed

Pointing out the opportunity to expand the market for cottonseed meal in chick and broiler rations, the Educational Service of the National Cottonseed Products Association has offered cottonseed oil mills a self-mailing circular entitled "Cottonseed Meal for Chick and Broiler Rations" which is designed to encourage the use of cottonseed meal by poultry raisers and feed mixers.

Copies of the circular may be obtained from the Educational Service for $2 a hundred, plus shipping costs.

CALENDAR

Conventions • Meetings • Events

• March 4-5—Georgia Cotton Ginners' Association annual convention. Henry Grady Hotel, Atlanta, Ga. Warren B. Hodge, Unadilla, Ga., president.

• March 15-16 — National Cotton Ginners' Association annual convention. Peabody Hotel, Memphis, Tenn. Horace Hayden, 1004 Perrine Bldg., Oklahoma City 2, Okla., executive vice-president.

• March 23-24—Texas Cotton Association annual convention. Baker Hotel, Dallas, Texas. General Arrangements Committee, P. O. Box 726, Waco, Texas.

• April 2-3-4—Texas Cotton Ginners' Association annual convention. Fair Park, Dallas. Jay C. Stilley, 109 N. Second Ave., Dallas, executive vice-president. For exhibit space, write R. Haughton, president, Gin Machinery and Supply Association, P. O. Box 444 (3116 Commerce St.), Dallas 1, Texas.

• April 9-10—Valley Oilseed Processors Association annual convention. Buena Vista Hotel, Biloxi, Miss. C. E. Garner, 1024 Exchange Bldg., Memphis, Tenn., secretary.

• May 1-3—American Oil Chemists' Society spring meeting. Roosevelt Hotel, New Orleans, La. H. L. Roschen, Swift & Co., Chicago, Ill., secretary.

• May 14-15-16—Fifty-fifth annual convention, National Cottonseed Products Association. Palm Beach Biltmore Hotel, Palm Beach, Fla. S. M. Harmon, Sterick Bldg., Memphis, Tenn., secretary-treasurer.

• May 30-31-June 1—National Oil Mill Superintendents Association annual meeting. Plaza Hotel, San Antonio, Texas. H. E. Wilson, Wharton, Texas, secretary-treasurer.

• June 3-4-5—Joint convention North Carolina Cottonseed Crushers Association and South Carolina Cotton Seed Crushers' Association. The Cavalier, Virginia Beach, Va. Mrs. M. U. Hogue, 612 Lawyers Bldg., Raleigh, secretary of North Carolina association; Mrs. Durrett L. Williams, 609 Palmetto Bldg., Columbia, secretary of South Carolina association.

• June 4-5—Arkansas-Missouri Ginners' Association annual convention. Arlington Hotel, Hot Springs, Ark. J. W. Karsten, Jr., Kennett, Mo., executive vice-president-secretary-treasurer.

• June 4-5 — Oklahoma Cottonseed Crushers' Association annual convention. Lake Murray Lodge, Ardmore, Okla. Horace Hayden, 1004 Perrine Bldg., Oklahoma City 2, Okla., secretary.

• June 10-11-12 — Texas Cottonseed Crushers' Association annual convention. Shamrock Hotel, Houston, Texas. Jack Whetstone, 624 Wilson Bldg., Dallas 1, Texas, secretary.

• June 14-15 — Mississippi Cottonseed Crushers Association annual convention. Hotel Buena Vista, Biloxi, Miss. J. A. Rogers, P. O. Box 3581, West Jackson Sta., Jackson, Miss., secretary.

• June 18-19 — Joint convention Alabama-Florida Cottonseed Products Association and Georgia Cottonseed Crushers' Association. San Carlos Hotel, Pensacola, Fla. T. R. Cain, Professional Center Bldg., Montgomery 4, Ala., secretary of Alabama-Florida association; J. E. Moses, 318 Grand Theatre Bldg., Atlanta 3, secretary of Georgia association.

• June 20-21-22 — Tri-States Cottonseed Oil Mill Superintendents' Association annual convention. Biltmore Hotel, Atlanta, Ga. L. E. Roberts, 998 Kansas, Memphis 5, Tenn., secretary-treasurer.

Conferees Consider Gains In Agricultural Aviation

Voicing the complaint of aerial croppers that present interpretation of the Wage and Hour Law will "put them out of business," delegates at the close of the third annual National Agricultural Aviation Conference in Memphis, Feb. 19-20, went on record as being opposed to application of the legislation to persons in this industry.

The action came at the end of a two-day session at which delegates heard state and government researchers, CAA officials, aerial croppers, and representatives of industries allied with agricutural aviation discuss the progress and problems of the trade.

Aerial agriculture has come a long way since a researcher crawled out on the wing of a biplane in Nevada in 1918 and released a sack of insecticide dust over a field of alfalfa, a government scientist pointed out in an opening day address, noting that planes now are used for seeding, fertilizing, controlling weeds and insects, and for surveying.

"Today aircraft is an esssential part of farming practice," Dr. H. L. Haller, special assistant, Bureau of Entomology and Plant Quarantine, USDA, Washington, told the more than 200 delegates at the Hotel Peabody.

Emphasizing the need of an agricultural aviation program on the state level, Ralph R. Young, Columbus, agricultural coordinator, Ohio Aviation Board, pointed out that in 1950 over 5,000 agriculturally equipped planes spread over 350 million pounds of pesticides. Of the more than 60 industrial uses for planes, more than 40 are in the field of agriculture, he noted. In his own state use of planes for agriculture had increased 64 per cent over 1948.

Dr. J. E. Adams, head, agronomy and soils department, Texas A. & M. College, presided over a panel on fertilizing, seeding and defoliation. Taking part in the discussion were Dr. W. H. Tharp, principal physiologist, Division of Cotton and Other Fiber Crops, USDA-BPISAE, Beltsville, Md.; R. D. Barden, department of agricultural engineering, Ohio State University; Bill Marsh, Marsh Flying Service, Phoenix, Ariz.; and J. O. Dockins, Stuttgart, Ark., assistant director in charge, Rice Branch Experiment Station.

Since the airplane can fertilize and seed at the rate of five to seven acres per minute, its advantages of timeliness of operation and large acreage use become quite apparent, Mr. Barden emphasized in stressing the need for greater research to develop equipment for this agricultural practice.

Dr. Tharp said that airplanes are being used extensively for defoliating cotton and urged that operators closely follow recommendations in applying materials. Good results are being obtained, he said, in areas where large acreages of cotton are being defoliated with chemicals applied from the air.

Problems in aerial application of insecticides were discussed by Arthur Geiser, Denver, chief pilot, Division of Grasshopper Control, USDA-BEPQ.

Final discussion on the program was concerned with insect and disease control. S. L. Calhoun, Stoneville, Miss., entomologist, Bureau of Entomology and Plant Quarantine, one of the participants, stressed that the insecticides or method of application in cotton insect control is not nearly as important as maintaining a proper schedule of applications.

The meeting was sponsored by the National Flying Farmers' Association. Cooperating were the National Cotton Council, U.S. Department of Agriculture, land grant colleges, Civil Aeronautics Administration, National Agricultural Chemicals Association, National Fertilizer Association, aerial applicators, state aviation officials, state Boards of Agriculture, Committee of Agriculture, API, and Farm Equipment Institute.

USDA to Review Federal Plant Quarantine Rules

All federal plant quarantine regulations and orders affecting the importation of cotton and cotton products will be thoroughly reviewed at a hearing to be held in Washington on March 28, the Secretary of Agriculture has announced.

This hearing is preliminary to the contemplated reissuance as a single document of six regulations or orders relating to the entry of foreign cotton or cotton products into the U.S. Present and future warranted restrictions on the domestic movement of similar commodities from Hawaii, Puerto Rica, and the Virgin Islands also will be considered at the hearing.

It is the Department's intention, the Secretary stated, to consider the currently known facts regarding the risk of introducing plant pests on cotton imports. These risks will be the basis for any later revision of the present requirements, some of which are of 30 years' standing.

Classified Advertising

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FOR SALE — Three-section cage French screw presses with 40 h.p. flange mounted motor and tempering bin. Also No. 1 Anderson expellers, belt driven, atractively priced. Inquire—Box 493, care The Cotton Gin and Oil Mill Press, P.O. Box 444, Dallas 1, Texas.

FOR SALE—One—W. S. Tyler Co. Niagara Vibrating Screen style 100, serial number 8198. Two —Richmond Manufacturing Co. Niagara Super Sifters No. 4 x 10, serial numbers 21749 and 21750. All equipment offered subject to prior sale.—Address: Archer-Daniels-Midland Company, 600 Roanoke Building, Minneapolis 2, Minnesota.

OIL MILL MACHINERY FOR SALE: Cookers — Pumps — Presses — Cylinders — Heads — Columns — Formers — Accumulators — Hydraulic Pumps — Hot Cake Cutters and Strippers — Cake Bin Feeders — Filter Presses, 32x32 with 49 Plates — Electric Motors, 15 to 150 h.p. with starters — Shaft Coupling and Pulleys — Reitz Disintegrator with 75 h.p. motor — 30" — 36" Chandler Hullers — Small Set Crimping Rolls — 2 Sets Cracking Rolls — 1 Set 60" Crushing Rolls — Post and Pillow Block Ball Bearings — Conveyor Heads and Hangers — Enclosed Right Angle Drives — Elevator Belts, Buckets, Sprockets and Chain — Carver Lint Tailing Beater and Shaker — Brust Grabbot Machines.—Write, wire or phone Sproles & Cook Machinery Co., Inc., 151 Howell Street, Dallas, Texas. Telephone PRospect 5958.

PRESS ROOM MACHINERY FOR SALE—Hydraulic Presses—Hydraulic Pump—Cake Former —Cake Cutter—Accumulator—XX Hydraulic Pipe —also Bauer Bros. Attrition Mill. For further details write—Suffolk Oil Mill, Inc., Suffolk, Va.

FOR SALE—Complete hydraulic press room with 5 high cooker, lint room Butters machine, 18 Carver 141 saw-linters, flue system.—Address Box "77," c/o Cotton Gin and Oil Mill Press, P. O. Box 444, Dallas, Texas.

FOR SALE—Delinting equipment for planting seed, Carver 106-141 saw linters.—V. A. Lessor & Co. Oil Mill Machinery, P. O. Box 108, Fort Worth, Texas.

FOR SALE—Oil mill equipment including Anderson expellers and French screw presses.—Pittock and Associates Glen Riddle, Pa.

FOR SALE—72-85" cookers, rolls, formers, cake presses and parts, accumulators-pumps, hull-packers, Bauer No. 153 separating units, bar and disc hullers, beaters-shakers, Carver linters, single box baleing presses, filter presses, expellers, attrition mills, pellet machines, pheumatic seed unloader. If it's used in oil mill, we have it. V. A. Lessor and Co., P. O. Box No. 108, Fort Worth, Texas.

Gin Equipment for Sale

FOR SALE—One 5-80 saw Murray gin outfit with glass front gins, good shape, Mitchell super units, after-cleaners and super-jems, Murray single conveyor distributor, Murray steel-bound up-packing press complete—Mitchell equipment two years old. One 4-80 saw Murray glass front gin outfit with Mitchell super units, Murray double conveyor distributor, less transmission and press. One 3-80 saw Murray gin outfit with Mitchell super units, Murray double conveyor distributor, less press and fans. This outfit has run one season and has ginned less than 600 bales.—W. L. Gladish, Lawrenceburg, Tennessee.

FOR SALE—5-80 Continental brush gin stands. 5 80 saw Continental double X cleaner feeders.—Walter Craft, P. O. Box 1029, Carlsbad, N. M.

FOR SALE—Two almost new installations of 6 cylinder 72" after cleaners for 10' O. H. Continental bur machines. One above floor set of lint flues, complete with transitions, and supports for Continental gin stands. — Farmers Cooperative Gins, Munday, Texas. Phone 25.

FOR SALE—We have for sale the following gin equipment: 4 - Munger - Double Rib-Huller-Brush Gins #HG-103 RA-Direct Connections with Reclaimer Breasts. 4-Double X-Huller-Cleaner-Feeders Model D. One Continental conveyor distributor, practically new. One pair Howe seed scales. One #40 Continental fan, and 1 super blast fan. One practically new lint flue Model C-Continental gins. Plenty of shafts, line shaft, conveyors, and air lines. All of this equipment is in good condition and will sell all or any part.—J. D. Davis Gin and Feed Mill, Leonard, Texas.

FOR SALE—One 70" Hardwicke-Etter stub 11-shelf tower drier, three way by-pass and steel supports. Two 10-section Lummus thermo cleaners. Two Mitchell burners. Two Continental hot air vacuum boxes. One 3-80 Continental oval steel side discharge condenser. Two Wichita steel 50" separators .One Continental 50" steel separator. One 38" steel Stacy separator. 4-66" Super Mitchells with flat belt drive. One Continental 50" 8-cylinder steel inclined cleaner. One long and one short all steel by-pass conveyors for 2-10' Hardwicke-Etter bur machines and 50" cleaners. 4-80 saw Hardwicke-Etter huller feeders. 5-80 saw A. B. all steel Cen-Tennial Commander gins, 1-80 saw Cen-Tennial Commander all steel brush gin. One slightly used 34' Howe wagonscale with plank deck. One 24' Howe wagon scale with plank deck. Six new Fairbanks-Morse engine heads. New Climax butane or gas engines. Bagging and ties.—Bill Smith, Box 694, Phones 9626 and 7847, Abilene, Texas.

FOR SALE—If interested in buying or selling a Texas Cotton Gin, it will be to your advantage to contact me. Have lots of prospective buyers. Give me your price. If its right I can get quick results. —M. M. Phillips, Phone 3-1171, P. O. Box 1288 Corpus Christi, Texas.

FOR SALE — Complete 5-80 Cen-Tennial plant with steam power less buildings.—W. C. High Gin, Tahoka, Texas.

FOR SALE—2-Complete Batteries 4-80 Saw Murray air blast ball bearing gins. These outfits are equipped with modern Mitchell Super-Units, conveyor distributors, 18-shelf tower driers, seed scales and all steel, swing door up-packing presses. The trampers on these presses have been used only one year. Both outfits are complete in every respect and are in excellent condition, and will be sold at a very reasonable price for quick removal, as we are installing a complete new outfit.—Hartsville Oil Mill, Hartsville, S. C.

FOR SALE— Modern gin in good operating condition located in north Texas containing 5-80 saw gins, H-E cleaning machinery and dryer, Le-Roi gas engine, good buildings, average ginning during past 4 years exceeded 2500 bales. Owner retiring.—Write Box "TA" c/o The Cotton Gin and Oil Mill Press, Box 444, Dallas 1, Texas.

BUR EXTRACTING and cleaning machinery— Four 66" Mitchell pressed steel, ball bearing "double decked" flat belt extractor. Four 66", 1932 model pressed steel ball bearing Mitchells. Five 80-saw model "H" triple saw Mitchells. One 58" cast iron F.E.C. ball bearing Mitchell. Five 80-saw Murray V-belt Bleweths. Three 60" Continental steel "double X", model "D" extractors. Two 60" Continental steel "triple X" model "D" extractors. One 14 foot Hardwicke-Etter wood frame extractor with inlet and return conveyors, excellent. One 14 foot Stacy steel three cylinder incline ball bearing after cleaner. One 10 foot Hart steel three cylinder incline ball bearing after cleaner. Two Murray steel "Quad" cleaners. Two five cylinder Hardwicke-Etter wood incline cleaners. Two 52" Murray steel type "MS" Separators. Two 50" Hardwicke-Etter wood separators. New "Government type" Tower Dryers, gas and butane heaters, etc. Tell us your needs and what you have for sale or trade.—R. B. Strickland & Co., 13-A Hackberry St. Tel. 2-8141, Waco, Texas.

FOR SALE—To be moved, complete 4-80 Murray gin, electric power, new inside seed scales. — Chapel Hill Gin Company, Chapel Hill, Texas.

FOR SALE—To be moved: 2-complete 4-80 saw Murray all steel gin outfits with up-packing all steel presses and steel condensers, less power; gin stands equipped with quick roll dumping device and glass panel fronts. One battery equipped with Mitchell 60" standard units, stub tower dryer and heat in Mitchells; other battery has Mitchell 60" super units with heat; both have Fairbanks seed scales. These outfits are in excellent condition and priced right for quick sale.—Taylor Oil and Peanut Mills, Division of Georgia Peanut Company, Moultrie, Georgia.

FOR SALE—Well equipped 5-80 Murray gin plant in most productive cotton section of Texas plains. All facilities. Anticipated ginning '51 over 5000 bales. Bargain price for immediate sale only $57,500.—Write Box J. K. c/o The Cotton Gin and Oil Mill Press, P. O. Box 444, Dallas 1, Texas.

FOR SALE — 5-40" Hardwicke-Etter roller gin stands equipped with 40" 2 cylinder cleaner feeders. Nearly new.—Walter Craft, P. O. Box 1029, Carlsbad, New Mexico

FOR SALE—To be moved, 5-80 Murray gin complete, with glass fronts, ball bearings, 6" mote conveyor, 100 h.p. electric motor, all in good condition.—G. M. Lomax Lumber Co., Ruston, La.

FOR SALE—Three steel bound Continental Paragon Presses with channel iron side supports, and counter-balanced doors. One Cameron all steel tramper. One Murray tramper, and one Murray three-plunger pump. Two Beaumier four-plunger pumps. Four 66" standard Mitchells with flat belt drive. Five 66" Super Mitchells with flat belt drive. Five 66" convertible Mitchells with flat belt drive. Five 60" Hardwicke-Etter huller-feeders. Five 80 saw Murray gins with glass fronts and lint flues. 5-80 D.C. A.B. Continental model "C" gins, new saws, ribs, rib rails, and lint flue, model 30 front. One 6-cylinder air line all steel cleaner. Two center feed all steel 12' Murray bur machines. Two 10' Hardwicke-Etter wood bur machines. One Wichita all steel 14' bur machine with 3 cylinder 14' all steel after cleaners. One 14' Hardwicke-Etter wood bur machine rebuilt 2,500 bales back with 3 cylinder all steel 14' after cleaner. Two 14' Hardwicke-Etter wood bur machines. Several gins at present location as well as to be moved. Several Skinner steam engines and boilers, or what do you want to buy or trade.—Bill Smith, Abilene, Texas, Box 694, Phones 4-9626 and 4-7847.

FOR SALE—What should be some money makers. A good 5-80 Continental gin, ready to gin cotton, located in a county where there will be 10,000 acres or more planted this year. Being sacrificed at $15,000 with some terms if desired. Also have a bargain in the Valley. A 4-80 Continental, well located, ready to gin cotton. Priced at $40,000 with some terms. Have an all steel 5-70 Continental to move. This was bought new three years ago. Now offered for half of original cost, or $12,000. If you are interested in gin bargains it will be to your advantage to contact me.—Call, write or wire M. M. Phillips, Phones 3-1171 or 3-3914, P. O. Box 1288, Corpus Christi, Texas.

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FOR SALE—Continental steel dryer. Two 18' sections with bypass. This dryer is in good condition. If interested contact R. M. Eubank.—Oso Co-op. Gin Co., Rt. 3, Box 425, Corpus Christi, Texas.

FOR SALE—One four stand 80-saw Continental Gin complete with double x Huller cleaner feeders, conveyor distributor, four drum incline cleaner, E. J. Tramper and Paragon up pack press. Also includes Caterpillar D13000 diesel motor. Will sell at bargain.—Write J. L. Mullens, Heber Springs, Ark.

FOR SALE—4-80 Lummus gins, 6 cyl. Mitchell Jembo dryer and cleaner, 4 Mitchell feeders and extractors, 10 ft. Lummus bull extractor with 4 cyl. after cleaners, 242 h.p. Twin City engine, 3 room house, 3 acres of land. Located in the heart of West Texas cotton belt. Will gin between 4000 and 5000 bales in 1951 season.—Countyline Gin, Rt. 1, O'Donnell, Texas.

FOR SALE—Some of our special bargains: AIR BLAST GINS, direct connected type: Three 80-saw Murray steel 6" mote conveyor. Three 80-saw Murray steel, old style. Four 70-saw Lummus "Automatic" ball bearing, with roll dump levers. Eight 80-saw Munger ball bearing. Five 80-saw Gullett. Three 70-saw Murray steel 6" mote conveyor. Three 70-saw Murray steel 4" mote conveyor. Four 70-saw Pratt, steel frame. Four 70-saw Munger, iron frame, good order, $100.00 each. BRUSH GINS: Four 80-saw Murray, old style steel, with ball bearing brushes, almost new and good saws and ribs. Five 80-saw Munger iron frame, I.S. & B.D. Four 70-saw Pratt, wood frame, excellent condition, $100.00 each. PRESSES AND OTHER ITEMS: One Continental "Paragon" heavy duty steel bound press with Ram and Casing. One Murray "PX" heavy duty steel bound press with or without late type Hydraulic Ram and Casing and Murray triplex belted hydraulic pump. One good, sound, Continental old style press with fully steel bound top doors, hinged in steel, $500.00 at location. One 72" square type Continental steel "up draft" condenser with dust flues. Can be changed to down draft. One 50" Murray square type steel down draft condenser. One Continental vertical triplex hydraulic pump with one pulley for electric drive. Two rebuilt Beaumier 4-plunger belted hydraulic pumps. Several wood and steel bucket elevators. One Hardwicke-Etter double hopper seed scale. One 6'x22' 10-ton Fairbanks pit type platform scale with steel office fixtures, $475.00. One double 35" Clarage fan. 35", 40" and 45" rebuilt fans. New Phelps fans, all sizes and types in Waco stock. Hydraulic rams and casings, conveyors, pulleys, belting and transmission equipment. New "Government type" tower driers. Gas and Butane heaters, etc. Get our quotations before buying. — R. B. Strickland & Co., 13-A Hackberry St., Tel. 2-8141, Waco, Texas.

Equipment Wanted

WANTED—70" Hardwicke-Etter separator and big reel Murray drier. Must be in first class condition and worth the money.—Floyd Weeks, Wills Point, Texas.

WANTED TO BUY—Good used gin machinery of any kind.—Bill Smith, Abilene, Texas.

WANTED—Late model 4 or 5-80 Lummus gins with steel building. Give location, complete description and price.—Jenkins Bros. Gin Co., Moultrie, Ga.

COTTON GIN wanted immediately. Will pay cash for plant in good condition, to be moved, with or without building. No junk or obsolete equipment considered. Quick inspection assured.—Wire or phone James Poe, Colonial Court, Brownsville, Texas. Phone 2-9872.

WANT TO BUY good used gin to be moved. — Write description and particulars to Box 442 Celina, Texas. Phone 98-J.

WANT TO BUY—60" or 72" steel condenser.—Bill Smith, Abilene, Texas.

Personnel Ads

WANTED—Ginner capable handling new Murray-Mitchell gin and office man with good accounting experience. Year round job. Give reference and experience.—Box 548, Artesia, New Mexico.

WANTED—Experienced cotton gin operator to help move gin to our location. Have permanent job for good man in cotton gin and oil mill.—Curtis Peanut Co., Inc., Pearsall, Texas.

WANTED—Job as ginner and maintenance man. Year round work. References on request. 20 years experience.—Write Box 107, Wingate, Texas.

ALL AROUND GINNER—Desires position. twenty-seven years experience, erecting maintenance and operating. Would like steady employment anywhere.—A. V. Saucier, 4101 Webster St., Monroe, Louisiana.

WANTED—Job as gin manager or maintenance of a line of gins. Can build from ground. Years experience. Plenty references. Any make gins.—P.O. Box 72, Temple, Texas.

Power Units and Miscellaneous

ALL STEEL BUILDINGS for cotton industry—warehouses, cottonseed houses and gin buildings. —Marvin R. Mitchell Construction Co., 1220 Rock Island, Dallas, Texas. Phone RA-5615.

FOR SALE—Twin City, 6 cylinder, 8x9 model NE natural gas engine with nine belt V-Drive and starter. Good condition. — Box 416, Grandfield, Oklahoma.

FOR SALE—International Cotton Picker. Picked 11 bales, $7500.00.—Write Box "T", c/o The Cotton Gin and Oil Mill Press, P. O. Box 444, Dallas 1, Texas.

LEROI ENGINES—We deliver "turn-key" cotton gin power installations. Our engineers prepared to install new or rebuilt LeRoi engines in our territory, ranging from 225 h.p. to 450 h.p. We furnish cooling tower and coils, water and gas line pipe, sheaves, belts—now ready for immediate delivery. Scheduled for delivery in April, May, June and July, new LeRoi power engines. We maintain a complete stock of LeRoi engine replacement parts and have expert service men on duty 24 hours.—Nortex Engine and Equipment Company, LeRoi Engine Distributors, P. O. Box 855, Wichita Falls, Texas.

FOR SALE—Allis Chalmers tandem compound engine, 14x30x36, with Wheeler condensing equipment. One Heine 300 h.p. water-tube boiler—175 lbs. working pressure. — Write, wire or phone Sproles & Cook Machinery Co., Inc., 151 Howell Street, Dallas, Texas. Telephone PRospect 5958.

FOR SALE—Two rebuilt 8 x 9 - 4 cylinder Twin City engines. One rebuilt 8 x 9 - 6 cylinder Twin City Engine. Sales, parts and service on all sizes of Twin City engines.—Fort Worth Machinery Company, 1123 East Berry, Fort Worth, Texas.

FOR SALE—Climax gas engines, Murphy diesel engines (dual fuel), 1-8 cylinder RXVI LeRoi Mill type, with starting engine, 1-8 cylinder D1700 Caterpillar Mill type with starting engine. Electric generator sets, all sizes. Electric motors, all sizes with starters—partial list—150 h.p., 200 h.p., 250 h.p., 300 h.p., 350 h.p., 400 h.p. V-Drives. Complete repair shop for engine rebuilding and motor rewinding.—H & H Equipment Company, Inc., 337 South Industrial Blvd., Dallas, Texas. RIverside-3501; WOodlawn-7839.

POWER—One model RA4S, 6-cylinder LeRoi, 140 h.p. power unit. One model RX1, 125 h.p., 4-cylinder LeRoi power unit. One 25-35 h.p. Waukesha power unit. Electric motors: One 60 h.p., 2300 volt slip-ring with controls. One 20 h.p., 2300 volt slip ring with controls. One 50 h.p. G.E., 220 volt, 1200 rpm. squirrel cage, in Waco stock. New and rebuilt motors in a large range of sizes available for prompt shipment. Also one 80 h.p. model 32 cold starting Fairbanks-Morse Diesel, reconditioned, on testing block, Waco stock. One 60 h.p., single cylinder model 32 cold starting Fairbanks-Morse Diesel engine with clutch and auxiliary equipment, on foundation, East Texas $500.00. One 100 h.p. Fairbanks-Morse semi-Diesel engine, on foundation with clutch and stub-shaft, $500.00. —R. B. Strickland & Co., 13-A Hackberry St., Tel. 2-8141, Waco, Texas.

FOR SALE—One Le Roi V-80 1945 model natural gas engine in excellent condition. One good steam power plant complete with 16x16 Skinner engine 18x72 boiler and stack—bargain. One 40 h.p. 220 volt, 900 rpm., electric motor with starter switch. One 60 h.p. 220 volt, 1800 rpm., electric motor with starter switch.—Bill Smith, Box 694, Abilene, Texas, Phones—4-9626 and 4-7847.

U. S. Fats and Oils Trade Again Large in 1950

The U.S. in 1950 again engaged in a large volume of trade in fats, oils and oilseed. The total 1950 volume of imports and exports, both in terms of oil, was nearly equal to that of 1949. However, imports in terms of oil were up somewhat from 1949, while exports were down.

Spirited activity in fats and oils movements developed after the outbreak of war in Korea, and particularly in the closing months of the year. And the United States—like several other nations—took steps to procure, or augment, supplies of fats and oils most needed should war break out in other world areas and availabilities be cut off.

American Long Staples Are Equal to Egyptian Cotton

A long standing belief was exploded by the National Cotton Council this week when it revealed results of a survey which showed that the strength of yarns made from American grown long staple cottons equal or surpass that of Egyptian cottons.

The survey proves that American cotton breeders have developed extra long staple varieties that are as good or better than the best Egyptian cottons, the Council pointed out.

Six of eight cotton mills reporting to the Council on the performance of Amsak cotton, an American variety, declared that yarn spun from this fiber was as strong or stronger than that spun from Karnak, the finest Egyptian cotton. Amsak is grown in Arizona, New Mexico, and the area around El Paso.

Georgia Farm Mechanization Conference Is Scheduled

Members of the Atlanta Farm Equipment Club will cooperate with the agricultural engineering division of the University of Georgia College of Agriculture in sponsoring Georgia's first Farm Mechanization Conference, April 24 and 25.

Approximately a dozen farm machinery and equipment firms will invite their Georgia dealers to attend the meeting where outstanding persons in the farm machinery industry and agricultural experts of the College of Agriculture will participate on the program. In addition, many of the state's agricultural leaders are expected to attend.

The conference is to be held on the College of Agriculture campus at Athens.

R. H. Driftmier, chairman of the College of Agriculture division of agricultural engineering, originated the idea for such a conference, and present plans call for an annual conference in the future.

In speaking of the forthcoming meeting, University of Georgia President O. C. Aderhold referred to the amazing increase in the use of machinery on Georgia farms in recent years. "Georgians were using 2,500 farm tractors in 1930," he said, "as compared with 50,000 in 1950."

Cotton Insects Can And Must Be Controlled

(Continued from Page 29)

purpose here is to emphasize the particular importance of insect control, a measure which offers the farmer one of his greatest opportunities to obtain higher yields.

Despite the alarming number of individual cotton crop failures which were directly attributed to insect destruction in 1950, many farmers who followed recommended control programs achieved greater yields than ever before.

Tests across the Cotton Belt, not only in 1950 but over a period of many years, prove that farmers can produce more cotton and make more money if they will carry out pest control practices as recommended. The following examples should prove this point:

During the Fourth Annual Cotton Insect Control Conference, Dr. H. G. Johnston, Head, Department of Entomology at Texas A & M College, gave the following highly significant results: "——At College Station, the average of all small plat experiments for 1949, including recommended insecticides only, produced net gains over untreated checks ranging from 845 to 1,031 pounds of seed cotton per acre. These averages represent a total of 66 replicated plats, and an average of 6 to 8 applications for different insecticides. Incidentally, these gains represented a net profit of something like $85.00 to $115.00 per acre based upon average prices for 1949. Results of experiments in other areas in the Southwest were quite similar.——" Quoting Dr. Johnston further, "——At College Station the average of all small plat experiments for 1950, including only recommended insecticides, produced net gains over untreated checks ranging from 811 to 1,126 pounds of seed cotton per acre. ——In large scale experiments in 1950, results were equally as good as the small plat tests for 1949 and 1950. In 6 tests ranging in size from 1 to 40 acres, sprays were applied either with a tractor or an airplane. In these tests 6 to 12 applications were required and average net gains over the check ranged from 775 to 1,233 pounds of seed cotton per acre. The net profit from these tests ranged from $88.00 to $133.00 per acre. Any farmer who has fertile soil capable of producing good cotton yields can duplicate these results.——"

The Mississippi Agricultural Extension Service conducted a survey which showed that "——Mississippi farmers in 1950 saved more than 100 million dollars through proper use of insecticides on cotton in spite of the heaviest boll weevil infestation ever recorded and the heaviest rain fall in 38 years.——"

A simple calculation will indicate that this amount of money represented a value of approximately $50 for each of Mississippi's slightly more than two million acres in 1950. It should be borne in mind that this figure represented the return to cotton producers after the cost of conducting the control program.

In Alabama last year the Extension Service made a study of 154 farms representing 5,466 acres of cotton in 10 counties in the northern part of the State. On 28 farms producing 498 acres of cotton where no insect control was practiced, the estimated average yield of lint per acre was 280 pounds. In the same general area the estimated yield ranged from 432 pounds of lint per acre on 34 farms producing 636 acres when an average of 4 applications of poison was used, up to 741 pounds of lint per acre on 13 farms growing 1,043 acres using an average of 12.3 applications of insecticides.

In general, the past two "cotton insect years" have taught producers much concerning the control of cotton pests. To obtain desired results, producers have learned that a definite cotton insect control program must be followed. A "hit and miss" schedule in the past has, in general, represented a waste of time, money and insecticides. The consensus of authorities is that the most significant items in successful control are (a) proper timing of applications and (b) thorough coverage — provided that recommended materials are used.

Prior to 1947, only a very small portion of the cotton planted was properly protected against insects. Until that time, less than 40 million pounds of insecticides per year were used. The practice of applying insecticides to cotton has greatly expanded. Insecticides were used in the amount of approximately 500 million pounds of dust equivalent in 1950.

The agricultural chemicals industry has the capacity and the know-how to produce any reasonable supply of cotton insecticides which may be required in 1951. This same industry has the capacity to almost double its 1950 production. However, it's possible that this amount will not be produced due to scarcity of basic raw materials used in the manufacture of insecticides. Some of the more important materials that may become limiting factors in producing the necessary cotton insecticides for this year's crop are benzene, chlorine, arsenic and sulfur.

In the event 1951 is another "cotton insect year" and with an anticipated increased acreage, there is a strong possibility that some producers may experience difficulty in obtaining the desired kinds and quantities of cotton pesticides this year. This possibility is recognized here in order to point out that plans should be made in order to lessen the chances of a cotton insecticide shortage developing when our country is faced with a cotton crisis.

Each person who plans to produce cotton this year should decide immediately upon the type of insect control program he should practice. Once the basic decisions relative to kinds and amounts of insecticides to be used are made, a firm order should be placed with his dealer. The same procedure should be followed concerning the dusting or spraying equipment. In case custom applicators are employed, definite arrangements should be made.

On the surface the suggestion that individual producers may hold the key to the availability of essential insecticides this year may appear insignificant. However, it is recognized that, regardless of the availability of raw materials and manufacturing facilities, this practice is a large contributing factor. Many can recall the local supply situations which developed during both 1949 and 1950 when there were few problems of raw material supplies. Equitable distribution was the problem. If a producer waits until the day he needs insecticides to place his order, he may find that local stocks are depleted. The availability of freight cars may become critical this year. Early buying will lessen the probability of distribution bottleneck.

Many farmers who are not already accustomed to buying their insecticides early may raise the question concerning the possibility that the materials may not be needed. There are three ways of considering this possibility: In the first place, cotton insects occur in sufficient quantities in most locations each year to warrant control. Secondly, early purchasing of insecticides should be considered on the same basis as insurance. Most individuals take out insurance coverage on their homes, automobiles, etc., with the hope that they do not have the sad experience of collecting. Entomologists and agricultural economists point out that where insecticides are needed and are properly applied, farmers can expect from five to ten dollars in return for each dollar invested in cotton insect control at the current price levels for lint and seed. Finally, if the materials are not needed for the current crop they can be left in storage for use the following year.

Cotton ginners, crushers and other members of the cotton industry can play a vital role toward bringing about effective control of cotton pests this year. Both an opportunity and responsibility are presented more vividly in 1951 than ever before. The job which the cotton industry has been called upon to perform requires the intelligent, aggressive support of each individual. Local ginners, crushers and warehousemen can cooperate by (1) assuring that adequate quantities of insecticides and application equipment are available, (2) assisting producers in making suitable financial arrangements, (3) providing storage facilities, and (4) working with cotton production education agencies to be sure that producers have or receive the essential know-how to carry out an effective program.

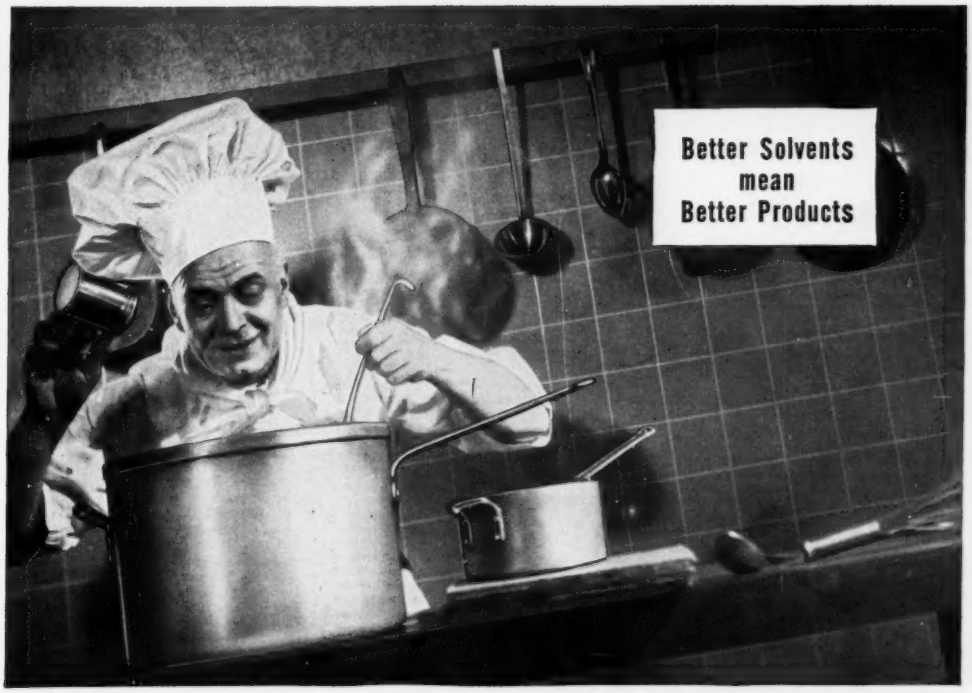
Conservation and the proper utilization of available insecticides and application equipment may be extremely important this year. It behooves the industry to keep this point clearly in the picture in developing and executing plans for a given program. Plans and programs should be kept flexible so that modifications may be made for the preferred control schedule. However, an alternate program should be mapped in the event of nonavailability of preferred supplies or equipment. There is a wide range of recommended materials and equipment from which to select in 1951. Don't delay making arrangements because preferred materials are not available. Such delays could result in many crop failures.

Cotton producers of this country can control insects. In order to produce the cotton which is so vital to our national security, cotton pests must be controlled in 1951.

Point IV Program Recruits Technical Agriculturists

USDA has announced that it is recruiting technical agriculturists to do foreign assignments for the Technical Assistance program, the so-called "Point IV" program. This work is designed to assist the economically underdeveloped areas of the world.

The Department's Office of Personnel is setting up a roster of qualified applicants and asking interested agriculturists to apply for the positions. Agriculturists employed will do research and extension work in cooperation with foreign governments. Agriculturists interested should write or fill out a Form 57, and then send it to USDA, Office of Personnel, Washington 25, D.C.



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DOC MacGEE SAYS: Skellysolve's "recipe" delivers *all* the qualities you look for in a solvent! Check these "ingredients" . . . Close boiling ranges. Low order of toxicity. Sweet odor. Low sulphur content.

What's more, Skellysolve has a minimum of unsaturates and pyrogenic decomposition products. Minimum of excessively volatile compounds. Fast vaporization from oils and meals. Low end points. Freedom from greasy residues. And low solvent losses are assured.

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Special solvent problem? Consult the Skelly Technical Laboratories and Skellysolve Technical Fieldmen. Write for complete information about Skellysolve now!

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SOLVENTS DIVISION, SKELLY OIL COMPANY,
KANSAS CITY, MISSOURI

Dusts Recommended for Control of Cotton Pests in Louisiana in 1951

Insect	Insecticide	Pounds of Insecticide Per Acre	Time to Treat	Intervals Between Applications
Boll weevil and cotton aphid	A. 3-5-40 mixture alternated with calcium arsenate	10-15 7-10	25% of squares punctured on high-producing land, and 10-15% of squares punctured on low-producing land (See discussion for over-wintered weevils)	4 or 5 days
	B. 3-5-40 mixture	10-15		Same
	C. 20-40 mixture	10-15		Same
	D. Calcium arsenate—2% nicotine mixture alternated with calcium arsenate	7-10		Same
Bollworms	A. 3-10-40 mixture	10-15	When eggs and 4 or 5 small bollworms per 100 plant tips are found	5 days
	B. 3-5-40 mixture	Same		Same
	C. 20-40 mixture	Same		Same
	D. 10% DDT—40% sulfur mixture	Same	Same	Same
Cotton leafworm	A. Calcium arsenate	10	When leafworms appear	When needed
	B. 20-40 mixture	Same	Same	Same
	C. 3-5 40 mixture	Same	Same	Same
Cotton fleahopper	A. 3-5-40 mixture	7-10	When 25 fleahoppers per 100 plant tips are found	7 to 10 days
	B. 20-40 mixture	Same	Same	Same
Spider mites	A. Sulfur	20-25	When mite injury appears	When needed
Cotton aphid	A. 3 5-40 mixture	10-15	When honeydew appears	When needed for "knockout"
	B. 3% nicotine-lime mixture	Same	Same	Same
Thrips	(See discussion on thrips)			

Sprays Recommended for Control of Cotton Pests in Louisiana in 1951

Remarks: The time to begin treatments and the intervals between applications should be the same as for dusts.

Insect	Insecticide	Pounds of Technical Insecticide Per Acre
Boll Weevil	Toxaphene	2 - 3
Bollworms	Toxaphene	2 - 3
	DDT	½ - 1
Cotton Leafworm	Toxaphene	2
Cotton Fleahopper	Toxaphene	1½ - 2
Thrips	(See discussion on thrips)	

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float away. For this reason, late afternoon and night applications are preferable to early-morning applications. *Complete coverage is necessary.*

Any type of cotton duster, either ground machine or airplane, may be used to apply dusts. The swath should never be wider than that which is recommended for the particular machine. Never depend on drift for coverage. In the case of airplane applications, the swath should never be wider than the wingspread of the airplane, or approximately 40 feet. Marking of swaths by flagging is essential.

Application of Sprays: Cotton insecticides applied as sprays are as effective as dusts where the amount of technical material applied per acre and the interval between applications are the same as those recommended for dusts.

Sprays may be applied by ground machine or airplane. The swath should never be wider than that which is recommended for the particular machine. Never depend on drift for coverage. In the case of airplane applications, the swath should never be wider than the wingspread of the airplane. Marking of swaths by flagging is essential.

When spraying with tractor equipment, use 1 nozzle per row on small cotton, 2 nozzles per row on cotton approximately twenty inches high, and 3 nozzles per row on cotton two feet or higher.

The following materials are suggested as substitutes in case of insecticide shortages:

Aldrin

Aldrin received wide usage for cotton insect control during 1950. It will control the boll weevil, thrips, cotton fleahopper, tarnished and rapid plant bug, and grasshopper. It will not control the bollworm, cotton aphid, or spider mites.

Aldrin may be applied either as a dust or spray. Dust formulations should consist of 2½% aldrin, 5% DDT and 40% sulfur (2½-5-40). It should be applied at the rate of 10 to 15 pounds per acre. This mixture includes DDT for bollworm control and sulfur to prevent a spider mite build-up. As a spray, ¼ to ½ pound of technical aldrin, per acre, should be applied for boll weevil control. Where bollworms are pests, ½ pound technical DDT, per acre, should be included.

Aldrin is toxic by skin absorption, swallowing, and breathing. It is recommended for use on cotton only when those applying it are fully aware of the hazards and will follow precautions prescribed by the manufacturer.

Dieldrin

Dieldrin has been used experimentally for two years—1949 and 1950. It is effective against the boll weevil, thrips, cotton fleahopper, tarnished and rapid plant bug, and fall armyworm. It will not control the bollworms at dosages suggested for the boll weevil. It will not control cotton aphids and spider mites. Dieldrin should be applied at the rate of .15 to .40 pound per acre. The exact dosage has not been definitely determined. Dust formulations should consist of either 1½ per cent or 2½ per cent of dieldrin, 5 per cent of DDT, and 40 per cent of sulfur. Where dieldrin is used as a spray, DDT should be added for bollworm control at the rate of one-half pound per acre.

Dieldrin is a very dangerous poison. It is recommended for cotton only where trained personnel or other individuals are in a position to assume full responsibility and to enforce proper precautions as prescribed by the manufacturers.

Parathion

Parathion is very effective for control of the cotton aphid and spider mite. A mixture of 1 per cent parathion and lime-free calcium arsenate will control the boll weevil, cotton aphid and spider mites. It will not control bollworms. Heavy aphid infestations can be effectively controlled with 1 per cent parathion.

Parathion is an extremely dangerous poison. It is recommended for cotton only where trained personnel or other individuals are in a position to assume full responsibility and to enforce proper precautions as prescribed by the manufacturers.

TEPP (Tetraethyl Pyrophosphate)

TEPP (tetraethyl pyrophosphate) is highly effective as a spray against the cotton aphid and spider mite. One pint of 20 per cent TEPP, or its equivalent, per acre, controls these pests. Best control is obtained when the plants are dry at the time of application. TEPP deteriorates very rapidly when exposed to moisture or moist air and is incompatible with alkaline materials.

Tetraethyl pyrophosphate is an extremely dangerous poison. It is recommended for use on cotton only where a qualified person is in a position to assume full responsibility and to enforce proper precautions as prescribed by the manufacturer.

Control of Insects in—

• Mississippi

Mississippi farmers in 1950 saved more than $100,000,000 through the proper use of insecticides on cotton in spite of the heaviest boll weevil infestation ever recorded and the heaviest rainfall in 38 years. The wise use of control measures in 1951 will undoubtedly pay big dividends.

General Suggestions

1. Buy insecticides early. The local dealer cannot possibly secure or carry in stock enough poison to fill all needs when every farmer waits until damage starts and then all want poison at once.

2. In airplane dusting or spraying, the planes should fly about 5 feet above the cotton and not attempt to cover swaths greater than the width of the plane. Flagging is desirable for dusting and absolutely necessary for spraying by plane.

3. The time of day will greatly affect the value of applications of organic poisons. Late afternoon and evening are the most desirable times for dust applications. Organic poison dusts should usually *not* be applied between 8 a.m. and 4 to 5 p.m. as rising air currents and high temperature will reduce their effectiveness.

4. Machines for catching boll weevils and other cotton insects are definitely *not recommended.* No mechanical device has yet been found by federal or state investigators to be equal to chemical methods for controlling cotton insects.

5. Sprays and dusts have been found

equally effective when each has been applied under proper conditions. Sprays are cheaper and more satisfactory for early season application, especially where spraying and cultivating can be done in one operation. They can also be applied over a wider range of conditions, even with fairly strong winds or in the middle of the day. Sprays will usually be more satisfactory when the plants are dry than when covered with dew. For seedling cotton, one nozzle per row with ground equipment is suggested, with 2 nozzles on cotton up to 20 inches high, and 3 nozzles on plants over 20 inches. Nozzles should be kept 6 to 10 inches from the plants to avoid leaf-burn. For safety, the spray boom on ground equipment should be located behind the operator. For airplane spraying, a rate of one to two gallons per acre is suggested.

6. Safety measures. All of the materials recommended for cotton insect control are poisonous and some are apparently very toxic to man. Insecticide containers should not be opened in closed rooms. Operators should be careful not to breathe fumes from concentrated sprays and dusts, and should avoid as far as possible breathing the diluted materials. Rubber gloves should be worn when handling concentrates and the hands washed frequently. A bath and a complete change of clothes should follow field operations or any work in which the clothing becomes saturated or contaminated. Where antidotes are known to be especially effective, as is the case of parathion, they should be carried by those using the chemicals, or available for immediate use if needed.

Schedule of Treatments

1. Cutworms and thrips. Poisoning is recommended when the 2 seed leaves unfold if cutworms and thrips are present. Poisoning for these pests will probably be needed generally throughout the Delta and may be necessary in the hill sections. From 1 to 3 applications at weekly intervals are suggested, according to the need.

2. Boll weevils, fleahoppers, and plant bugs. When the first square is seen (or the plant has about 7 to 9 leaves) applications should begin if boll weevils, fleahoppers and plant bugs are present. Three or four applications should be made at weekly intervals, ending about the last week in June or the first week in July.

3. General summer and late season control. After the early treatments described above, further poisoning should be based on weekly counts of punctured squares. A simple way is to pick 100 squares as you walk diagonally across a field from 2 directions, picking them equally from top, middle and lower limbs. The number of punctured squares out of each 100 picked is the percent infestation for that count. Some growers prefer examining 100 squares in each of several spots in a field, picking off only the punctured ones. The number punctured in each 100 shows the percent infestation at that spot. Summer applications should be made at 4 to 5-day intervals, beginning when 10 to 15% of the squares are punctured and continuing, if necessary, until the bolls are mature. When weevils begin migrating (usually around August 1) it may be necessary to reduce the time between applications and increase the amount of poison per acre.

Bollworms. These pests usually do not cause trouble until late July or early August but were much earlier in 1950. Poisoning should start immediately when 10% of the terminal buds are damaged, using at least one-half pound DDT per acre alone or in combination with all boll weevil poisons except with toxaphene in which case only one-fourth pound is needed.

Aphids or Lice. If aphids or plant lice develop following the use of DDT, calcium arsenate or other insecticides, control measures should be applied immediately. Benzene hexachloride, parathion, and tetraethyl pyrophosphate are recommended.

Red spiders. Red spiders may sometimes cause injury, especially in areas of insufficient rainfall. Dusting with 20 to 25 pounds sulfur per acre will control some species. Parathion dust at 1% strength or 1/10 pound per acre in sprays has also been effective. Tetraethyl pyrophosphate at 1/10 pound per acre is effective when applied with ground spray machines immediately after mixing.

Dust Insecticides Suggested for 1951

1. 3% gamma benzene hexachloride-5% DDT with or without sulphur. This mixture will control practically all cotton insects when used at 10 pounds per acre. If bollworms become numerous, the rate may be increased to 15 pounds per acre if the boll weevil is also a problem, otherwise 10 to 12 pounds per acre of 10% DDT will control the bollworms. The 3-5 mixture is used most economically when alternated at 4 to 5-day in-

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INSECTICIDE SUPPLY SITUATION

By LEA S. HITCHNER

Executive Secretary, National Agricultural Chemicals Association

THE YOUNG EDITION of Hopalong Cassidy, shown at the right in the picture, is quick on the draw and ready for action . . . and so is his daddy. Sprayer and spray material are on the farm, ready for use when needed to control insects that may attack his 1951 cotton crop. Growers should order materials at once and take delivery when they are offered.

LEA S. HITCHNER

GROWERS CAN approach the forthcoming cotton season with the certain knowledge that the agricultural chemical industry is doing its utmost to produce and effectively distribute adequate supplies of pesticides. However, because of the many variable factors it is not certain that all growers will be able to buy as much of certain types of materials as they would like. I should like to tell why this is so and recommend several courses of positive action.

First, the industry is prepared to offer farmers and growers the widest range of effective pest control chemicals in history. It has the plant capacity, skilled and scientific personnel, manufacturing know-how and distribution facilities to more than meet all agricultural demands. Limiting factors at this time are centered principally around supplies of raw materials.

Many of the raw materials essential to the pesticide industry are also required in tremendous volume for other phases of the nation's mobilization program. These raw materials include benzene, chlorine, sulfur, lead and copper. Other problems include manpower, packages and containers as well as transportation facilities. Consequently, leaders of the industry are most concerned at this time with the problem of balance; that is to attack each limiting factor as it occurs with the view of keeping the production and distribution lines moving.

Most of us can remember the posters widely displayed about a decade ago depicting an experienced worker with wrench in hand tugging at the letter "o" in production. That same force is being applied again by everyone in the industry except that the problems are somewhat different and vastly more complex than those which occurred in the previous mobilization effort. In fact by today's standards there were relatively few products at that time. These time-tested stand-bys, calcium and lead arsenate, coppers, nicotine, rotenone, and pyrethrum will undoubtedly play a very important role in future pest control. To this list of effective materials, industry has added many new pesticides, particularly of the chlorinated type.

Each manufacturer is doing his utmost to make available maximum supplies of all materials he produces for cotton insect control. However, since it appears that raw material limitations will reduce supplies of some of his products, his aim is to produce the largest volume of effective materials even though it may require, in some instances, the use of alternate pesticides by growers.

Since raw materials are the principal limiting factor in the production of agricultural chemicals, here is the situation

Some Should's and Should Not's

Growers SHOULD . . .

1 . . . **decide now on the pest control program they intend to follow.**

2 . . . **order the materials at once and take delivery when they are offered.**

3 . . . **be prepared to use alternate materials if they are unable to secure their first choice in sufficient quantity.**

Growers SHOULD NOT . . .

1 . . . **buy more pesticides than they expect to need for their own crop.**

2 . . . **buy pesticides on the black market if one should develop.**

3 . . . **write or wire government agencies or USDA until they are sure their own resourcefulness is exhausted. To remedy local supply conditions through such measures is usually unsuccessful because of the time involved and the fact that when material is ultimately secured it must come from dealers or manufacturers. Consequently, farmers should keep in close touch with their regular channels of supply.**

with regard to some of the more important ones.

Benzol—This is one of the basic chemicals needed for the production of many of our newer insecticides. Benzol is obtained from coal during coke production. Hence, the amount of benzol available is primarily tied to the amount of coke produced. While there are limited quantities available from petroleum by a special process, no real increase in benzol supply from petroleum sources may be expected before another two years. Imports from other countries are limited and much more expensive than domestic material.

Chlorine—Many of the important defense items are dependent upon chlorine. While the capacity of the country's chlorine production has been constantly increasing, it is materially insufficient to take care of present demands and cannot, in our opinion, be developed fast enough to take care of the probable increased demands of the defense program without cutting into civilian use. Practically all of the new synthetic organic insecticide compounds are chlorinated; that is, they contain chlorine. Here again we expect that the industry will be adversely affected because of the military defense needs for this item.

Sulfur—This critical raw material is also in short supply. Its value in use in pest control is widely known. However, its chief use is in the production of sulfuric acid, the demands for which always increase greatly in a war-time economy. You may have already experienced one effect of the sulfur and sulfuric acid shortage in the availability of superphosphate and mixed fertilizers. It is anticipated that its use as a diluent or carrier in agricultural pest control formulations, such as the 3-5-40 mix so widely used on cotton, will be limited as a conservation measure.

Lead and Copper—The demands of defense production will result in shortages of these metals and their derivatives. Certain uses for copper have already been greatly curtailed. The quantities of these materials which will be available for agricultural purposes is still uncertain.

Other chemicals used as defoliants, weed killers, plant hormones, etc., also require critical raw materials. How best to apportion production to these items will depend upon developments which occur as the season progresses.

Packages and containers, both metal and paper, are extremely tight at the present time and there is every prospect that they will be scarcer as the military defense program moves ahead.

Certain measures are being taken at the government level to encourage adequate supplies of pest control chemicals. Under the Defense Production Act, the National Production Authority will be responsible for the allocations of scarce materials. The U.S. Department of Agriculture has been designated as the claimant agency for the raw materials necessary to make pesticides. They have already established an organization in the Office of Materials and Facilities within the Production and Marketing Administration to determine the quantities of pesticides which will be required both for military and agricultural purposes, to ascertain the raw materials needed to manufacture them and to request same from the National Production Authority. The National Production Authority is now building its organization to handle agricultural chemical matters but it will be some time before it can function effectively. Our Association is working closely with both groups in an effort to assure an adequate supply of pest control chemicals for all growers and farmers.

Thus, while progress is being made, at the moment there is no machinery in Washington which can handle the problem nor is it anticipated that a functioning organization can be effective in time to materially help the situation as regards the 1951 season.

Another problem which has interfered with the distribution of pest control chemicals to the grower level is that of "DO" orders. The Armed Forces are now purchasing or placing orders for large quantities of various materials, including pest control chemicals. To expedite delivery, they apply a "DO" rating, which means that the order takes precedence over all other orders. For example, the government places a bid for a chemical with a "DO" rating. The company which accepts the contract then goes to a producer or formulator of chemicals and serves the "DO" rating upon him. The producer or formulator then finds that he does not have sufficient material to take care of his normal distribution requirements. At the present time, there is no procedure whereby these "DO" ratings can be distributed legally or equitably among the various agricultural chemical producers. As a result, domestic distribution has been greatly upset. NPA is studying this matter and by the time of publication it is hoped a solution will be found.

In addition members of the industry through NPA Committees are attacking these and other problems on an industry wide basis.

Industry wishes to assure growers that it is making every effort to produce and distribute enough materials to satisfy every grower's needs. At the present time, industry believes that it will be fairly successful and that growers generally will not suffer from an over-all shortage of agricultural chemicals, assuming normal pest infestations. However, abnormally heavy infestations could result in local shortages.

The NAC recommends that all farmers and growers decide promptly on the program which they intend to follow and place their orders immediately for the materials. NAC further recommends that growers be prepared to use alternate materials in case their number one choice is not available in sufficient quantity.

In periods of shortage there are always questions pertaining to the effectiveness of distribution of the available materials and we always hear some talk about government's taking over distribution from the industry and handling it on a rationing basis at the consumer level. It would be most unfortunate for the individual growers if the government were to discard the time-tested and proven pattern and attempt to distribute pest control materials itself. The industry has time and again demonstrated its usual capacity to take care of all distribution matters pertaining to agricultural chemicals upon an equitable basis and upon a timely basis. It is true that there will always be some small critical areas in times of scarcity but there is nothing the government could do about it if they were handling the distribution any more than the industry can. With industry's long experience in handling unforeseen outbreaks and with our widespread facilities for local production of formulations, warehousing and distribution through established distributors and dealers, it is felt that the best possible results for growers are now being secured and that a change of any kind would be an invitation to chaos.

Thus it will pay growers to follow carefully the recommended "do's and don'ts" in the box accompanying this article. By so doing growers will assist manufacturers in making the best utilization of available raw materials. Since benzol, for instance, is used to make numerous insecticides and herbicides the manufacturer has the problem of deciding which materials to produce. Growers who order early will help him tailor his production to better meet their needs.

Cotton Insect Research Pays

(Continued from Page 31)

early, they would undoubtedly benefit to the extent of many millions of dollars annually in savings from losses due to the boll weevil.

Although insecticides are of great value in controlling cotton insects, cultural methods of control are often equally effective, less expensive and more practical.

Studies over the past few years have developed many new highly effective cotton insecticides. Today we have a much wider choice of chemical weapons than we had six to eight years ago.

It is not a simple matter to develop a new insecticide and establish its value for the control of any insect. Establishing the fact that it will kill the insect is only the preliminary step. More important and more time-consuming problems are to determine whether it will kill the insect under conditions surrounding its use and not cause harm, either directly or indirectly, to the crops it is intended to protect.

For many years, calcium arsenate dust was the only insecticide that gave effective control of the boll weevil. It was not entirely satisfactory, since its use frequently made conditions favorable for the development of heavy aphid infestations, and this was often followed by heavy infestations of the bollworm.

At least seven different chemicals or formulations have been evaluated recently and are recommended in certain states for general use or on an experimental basis for boll weevil control; these are benzene hexachloride, aldrin, dieldrin, toxaphene, heptachlor, chlordane, low-lime calcium arsenate plus parathion or benzene hexachloride. DDT has been added to all of these materials for an "all purpose" insecticide. Many different formulations and combinations of insecticides adapted to available equipment and condition of use have been produced.

The development of such a wide choice of chemicals, especially under conditions of scarcity, is an accomplishment of no small significance. The farmer now has facts concerning the relative merits of the different materials available and a choice of the cheapest and most effective means of control for a given area.

For many years sulfur was the only pesticide recommended for the control of spider mites on cotton. If applied at regular intervals throughout the season in combination with other insecticides, it will hold red spider mites in check, but it is not effective as a "knock-out" application for heavy infestations. Fur-

thermore, under present conditions sulfur has become seriously short in supply and alternate insecticides are urgently needed. As a result of research, several new chemicals are now available that probably are more effective. These include parathion, tetraethyl pyrophosphate, aramite, and EPN.

Several new chemicals have been evaluated for thrip control on cotton and are recommended in most of the cotton-growing states. They include dieldrin, toxaphene, benzene hexachloride, DDT, aldrin, heptachlor, chlordane, and tetraethyl pyrophosphate.

Probably the most important recent development in cotton insect control has been made in the application of insecticides. We have just entered a new era of cotton insect control with the use of low-gallonage concentrated emulsion sprays.

Sprays and dusts have been found equally effective when each has been applied under proper conditions. Sprays are cheaper and more satisfactory for early-season application, especially where spraying and cultivating can be done in one operation. Because of the small size of the plants, a greater concentration of the insecticide is obtained from a spray.

Sprays can be applied over a wide range of conditions, even with fairly strong wind. Effective spraying can be accomplished during the day when dusting would usually be ineffective. Sprays should be applied only when the plants are dry; poison runs off when the leaves are wet.

In tests in South Carolina, sprays made from wettable powders of toxaphene, chlordane, and benzene hexachloride plus DDT were applied with the regular two-row tobacco sprayer for boll weevil control. The sprayer was modified for spraying cotton so that one, two or three, high-volume type nozzles could be used per row. The volume of spray applied varied from about 12 gallons per acre with one nozzle per row to approximately 45 gallons with three nozzles per row.

Excellent boll weevil control was obtained with all materials tested. The seasonal average of boll weevil punctured squares was about 36 percent in the treated plots as compared with 90 percent in the untreated check; the gains in yield over the untreated check ranged from 808 to 1191 pounds of seed cotton per acre.

As a result of these tests, wettable powders of these materials are now recommended for the control of this insect in South Carolina with the use of a tobacco sprayer for the small farmer.

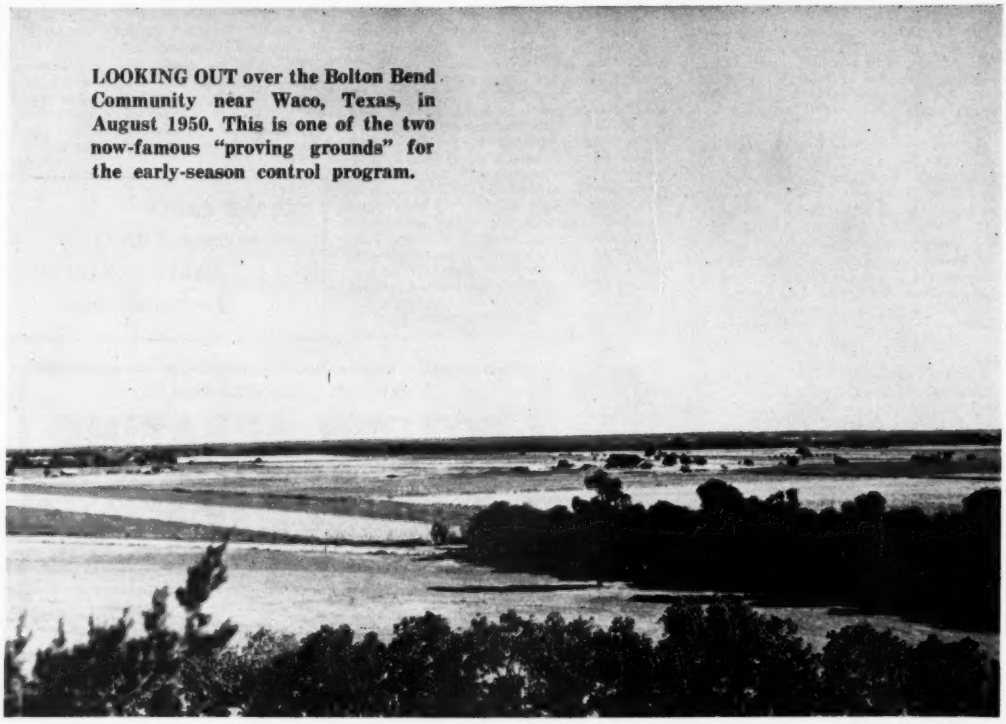
Research on cotton insect control requires the combined efforts of workers in many fields, including chemists, engineers, soil scientists, plant breeders, plant pathologists, and entomologists. Specialists in many different branches of entomology are required. One important group of entomologists often overlooked is the taxonomists, the specialists who classify and identify the insects. Their work is basic to all entomological research. We must know exactly with what insects we are working if our research results are to be of practical value. Cotton growers know that "red spiders" or spider mites at times cause serious damage to cotton. Formerly even most cotton entomologists thought there were only two or three kinds of spider mites on cotton. Sulfur was generally recommended for their control and when good results were not obtained, the weather or other factors were blamed. Now, as a result of research by taxonomists, we know there are at least 5 or 6 kinds or species of spider mites that attack cotton in this country. We have learned that sulfur controls some species and not others, and therefore, we must know which species is present.

There are at least four kinds of "bollworms" that resemble each other in size, shape and color and in the damage they do to cotton. All belong to the same family of insects, but they differ greatly in certain habits and may differ in their resistance or susceptibility to various insecticides. We depend upon the taxonomists to tell us what species are present in different instances.

Many other cases might be cited to show the absolute necessity of at all times having the assistance of specialists to identify each of the different groups of insects that attack cotton.

There is no doubt that research on cotton insect control has paid big dividends, especially during recent years, and this work should be expanded for the benefit of the farmers, the public in general, and our national security.

PLANT EARLY!
POISON EARLY!
HARVEST EARLY!
. . . for MORE Profit!



LOOKING OUT over the Bolton Bend Community near Waco, Texas, in August 1950. This is one of the two now-famous "proving grounds" for the early-season control program.

CG&OMPress Photo.

EARLY SEASON application of insecticides on a community-wide basis for cotton insect control in 1950

By K. P. EWING and C. R. PARENCIA, Jr.

EARLY SEASON CONTROL is frequently referred to as "preventive" control . . . but by whatever name it is called the results are just as sweet, the added net income it assures just as spendable.—ED.

THIS IS THE THIRD report of community experiments in early-season control of cotton insects. Experiments in 1948 and 1949 were reported in Bureau circulars E-772 and E-792.

Farmers in the Satin and Bolton Bend communities near Waco, Texas, cooperated in 1949 and again in 1950. The numbers of farmers cooperating and the treated acreages were greatly increased in each community in 1950.

The cooperation in the Satin community, which is in the northern part of Falls County, was extended to include the adjacent Asa community, which is in the southern part of McLennan County. In this report this enlarged area will be called the Satin-Asa community.

All cotton on 21 contiguous farms, or a total of 3,084 acres of cotton in the Satin-Asa community, received early-season insecticidal treatment. The treated area of this community was approximately 6 miles long and 2 to 4.5 miles wide. The large size of the treated area and the isolation afforded by the natural barriers—river, woods, brush, and pasture lands—surrounding most of the Satin-Asa community made possible the effective seasonal control of the boll weevil by the early-season application of insecticides.

Cotton was grown on 18 of the 19 farms in the Bolton Bend area in 1950. All cotton on 15 of the farms, or a total of 518 acres, received early-season appli-

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Table 1.—Summary of field records made in community experiments in early-season application of insecticides for cotton insect control near Waco, Texas.

Community and status of fields	Number of farms	Acres	Percent of weevil-punctured squares, week ending								Yield of lint, pounds per acre
			June 16	June 23	June 30	July 7	July 14	July 21	July 28	Average	
Satin-Asa:											
Early-treated	21	3,084	2	1	1	2	4	9	24	6	502
Untreated check	12	850	31	22	12	15	36	46	78	34	289
										Gain	213
Bolton Bend:											
Early-treated	15	518	3	5	3	4	10	9	34	10	304
Untreated check	5	204	35	51	34	23	27	46	69	41	192
										Gain	112
Both communities:											
Early-treated	36	3,602	2	3	2	3	7	9	29	8	474
Untreated check	17	1,054	34	36	23	19	31	46	74	38	270
										Gain	204

			Number of blooms per acre, week ending					
			June 23	June 27	June 30	July 3	July 7	Average
Averages:								
Early-treated	36	3,602	1,838	2,199	4,438	6,578	9,160	4,843
Untreated check	17	1,054	137	201	900	1,908	3,752	1,380

cations of insecticides. On one farm the cotton received several early-season treatments with a bug-catching machine, and on two farms no treatment of any kind for insect control was made during the season. The two untreated farms were located on the northeast edge of the area.

The entire Bolton Bend area is almost ideal for a community early-season insect-control project, because it is isolated by a 2-mile or more noncotton barrier on three sides with only small patches of cotton within ½ mile on the west side. It is bordered by the Bosque River and the City of Waco on the south, by the Bosque and Brazos rivers and marshy, wooded lands on the east, and by the Brazos and wooded areas on the north. Only the 15 farms that received early-season application of insecticides are included in this report of the Bolton Bend community. The treated area was approximately 3 miles in diameter.

There was a comparable untreated check area, also located in the Brazos River bottoms, for each of the two treated areas.

Treatments

A total of 3,602 acres of cotton on 36 farms received an average of 2.75 early-season applications of insecticides. Eighty-six (late-planted) acres received one application, 770 acres received two, 2,678 acres received three, and 68 acres received four. Ninety-three percent of the acreage was sprayed and 7 percent was dusted. A total of 345 acres received two late-season treatments for control of the boll weevil (*Anthonomus grandis* (Boh.)). A total of 240 acres were treated once for control of the cotton leafworm (*Alabama argillacea* (Hbn.)). About half of the late-season treatments consisted of dusts and the other half were sprays.

Two dusts were used, one containing 20 percent of toxaphene plus 40 percent of sulfur, and the other 5 percent of DDT plus 40 percent of sulfur, plus sufficient benzene hexachloride to give 3 percent of the gamma isomer in the finished dust.

Five emulsion spray formulations were used. Toxaphene was used on 76 percent of the acreage. The emulsion concentrates contained the following toxicants (quantities per gallon): (1) toxaphene 6 pounds, (2) toxaphene 4 pounds and DDT 2 pounds, (3) benzene hexachloride 0.6 pound of gamma isomer and DDT 1 pound, (4) dieldrin 2 pounds, and (5) aldrin 2 pounds.

The sprays were applied by 4-, 6-, or 8-row tractor-attachment machines. In the early treatments 2 gallons of spray per acre was applied at 60 pounds pressure per square inch, with one nozzle per row. One pint of the emulsion concentrate per acre was used in the first of the three early applications and 1 quart of the emulsion concentrate was used in each of the two later applications. The first application was primarily for control of thrips and the second and third applications were primarily for control of the boll weevil. Late-season sprays were applied at a rate of 6 gallons per acre, with three nozzles per row, and either 3 or 4 pints of the emulsion concentrate was used per acre.

The dust treatments were made with 6- or 8-row ground machines. The rate of early-season application was approximately 10 pounds per acre. Late-season dust applications were at the rate of about 15 pounds per acre. An airplane was used in a few of the late-season applications for boll weevil and leafworm control.

The dates for the early treatments ranged from May 21 to June 15, the averages being May 24 for the first application, May 31 for the second, and June 10 for the third. In 1950, records at Waco show that 86 percent of the boll weevils were out of hibernation by June 10 and 96 percent by June 15. No mid-season applications were made. Late-season treatments were made in late July and during August.

Profits from cotton-insect control in the Satin-Asa and Bolton Bend communities near Waco, Texas, 1950

	3,602 acres on 36 farms	
	Total	Per acre
Increased production		
Lint cotton, pounds	734,808	204
Cottonseed, pounds	1,084,202	301
Value of increased production:		
Lint at 40 cents per pound	$293,923	$81.60
Seed at 4½ cents per pound	48,789	13.55
Total value	$342,712	$95.15
Cost of increased production:		
Insecticides		
2.75 early applications at 78 cents each	$ 7,726	$ 2.15
0.25 late applications at $2 each	1,801	.50
Labor and machinery cost of applying insecticides 3 applications at 50 cents each	5,403	1.50
Total cost of poisoning	$ 14,930	$ 4.15
Picking increased production at $2 per cwt.	$ 40,342	$11.20
Ginning increased production at 65 cents per cwt. plus $3.25 per bale for bagging and ties	17,865	4.96
Total cost of production and poisoning	$ 73,137	$20.31
GROSS returns	$342,712	$95.15
NET returns	$269,575	$74.84

Insect Infestations

In central Texas the winter of 1949 was mild, and a heavy emergence of overwintered weevils resulted during the spring and early summer of 1950. Extremely dry weather during March and the first 10 days of April delayed cotton planting on many farms. Most of the cotton in the Satin-Asa community was planted during the last 2 weeks of April, the average date of planting being April 23. Only three fields were planted in May. The plantings were later in the Bolton Bend community—during the last week of April on six farms and in May on nine farms, the average planting date being May 6.

The rainfall was about normal during May, June, and July, the principal cotton-growing months. It was 1.4 inches below normal in August, and the hot winds and droughty conditions in August caused deterioration and shedding of

fruit on cotton that was not fully mature.

There was a medium to heavy infestation of thrips in practically every cotton field throughout central Texas during the latter half of May, and the damaging infestations continued in untreated fields until around the middle of June. The early-season insecticidal treatments in every field of both communities gave excellent control of the high infestations of thrips and started the cotton to growing and fruiting normally.

In the treated fields the early-season application of insecticides prevented damage by the cotton fleahopper (*Psallus seriatus* Reut.). This insect was present in damaging numbers in most untreated fields, although the infestations were never extremely high. During the peak of the infestation, around the middle of June, maximum infestations reached 40 to 60 fleahoppers per 100 terminals in the untreated fields, while 5 was the maximum for any field in the treated area.

The bollworm (*Heliothis armigera* (Hbn.)) caused practically no damage to either treated or untreated cotton. A threatening infestation of bollworms developed in one early-treated field of May-planted cotton in the Satin-Asa community. However, no poison was applied to this or to any other field in either community for bollworm control. Beneficial insects, particularly *Orius insidiosus* (Say), became very abundant in all early-treated fields shortly after the cotton began to bloom, and these predators evidently gave excellent control of bollworm eggs and young larvae.

Cotton in the Satin-Asa and Bolton Bend communities has for many years been severely damaged by the boll weevil. These communities are probably as well situated for heavy weevil carry-over and damage from year to year as any communities of similar size in central Texas. In 1950 the boll weevil was the insect of primary importance, and in the untreated cotton it caused tremendous damage.

The first of the three early-season treatments, which was primarily for thrips control, killed or thinned out the overwintering population of weevils to such an extent that comparable weevil population counts could not be made in all the treated and untreated cotton while it was in the presquare stage. However, sufficient presquare counts were made to establish the fact that relatively high populations of overwintered weevils—300 to 500 per acre—migrated into both treated and untreated areas.

Immediately after the third application, or during the week ending June 16, 2 percent of the squares in the treated and 34 percent in the untreated cotton were weevil-punctured. For 6 weeks after the third treatment the weevil infestation remained extremely low, 10 percent or less, in both treated communities. By the seventh week, or during the week ending July 28, the treated cotton was mature, squares were scarce, and the infestation had increased to 29 percent, compared with 74 percent in the untreated cotton. The average weevil infestation for the season (June 11 to July 28) was 8 percent in the treated and 38 percent in the untreated cotton (table 1).

The three early-season applications of insecticides gave entirely satisfactory control of the boll weevil throughout the season on 90 percent of the acreage. Ten percent of the acreage received two late-season applications for weevil control, 75 acres in the Satin-Asa community and 270 acres in the Bolton Bend community. Most of the cotton matured before leafworms appeared. Control measures for this insect were necessary on only 240 acres, all late-planted.

Fruiting, Yields, and Profits

Although in most fields that were to be treated thrips became numerous and caused severe damage for about a week before the first application of insecticides, there was a quick recovery after treatment and the treated cotton began growing and fruited normally at least 3 weeks earlier than the untreated cotton. It was harvested 2 to 3 weeks earlier.

Bloom counts showed that by July 15 the treated cotton had produced 117,695 bolls per acre and the untreated 37,757. On the basis that 90 bolls were required to produce a pound of seed cotton and that the lint turn-out was 37½ percent, the cotton had produced sufficient bolls by July 15 to average 490 pounds of lint per acre in the treated area and 157 pounds per acre in the untreated. This was a full crop for the treated cotton and very close

to the final yield, which was 474 pounds of lint per acre. Subsequent to July 15 fruiting increased in the untreated cotton but, as usual, late-season insects and unfavorable weather reduced the percentage of fruits that remained on the plants and that matured into pickable cotton.

The average production of lint cotton per acre in the two communities was 474 pounds from the treated and 270 pounds from the untreated cotton, a gain of 76 percent (table 1). The profit after deduction of all expenses of poisoning, picking, and ginning was $74.84 per acre.

Early Stalk Destruction

The advancement of maturity of the treated cotton by about 2 weeks made early harvest and early stalk destruction possible. Cotton picking was started in some fields by the second week in August and in most of the fields by August 20. Approximately 90 percent of the cotton was picked on 10 farms by August 31, on 18 additional farms by September 15, and on the remaining 8 farms by September 30. All picking was completed on 2 farms by September 15 and on 7 other farms by the end of September. Harvesting of most of the remaining cotton was finished by the middle of October, although a small amount remained to be harvested as late as November 1.

Stalk destruction had never been practiced to any extent in either community before 1950. Stalk-shredding machines were used in destroying most of the stalks. They were usually followed by tandem discs or plows. This combined treatment disposed of the stalks and at the same time turned under the green vegetation to enrich the soil. Stalk destruction was completed on 1 farm by September 10, and on 6 additional farms by September 30. Ninety percent or more of the stalks were destroyed on 29 of the 36 farms by October 15 and on all except 1 farm by November 1.

Discussion

Accurate yield records for the past 4 years (1947-50) are available for each of the 15 farms in the Bolton Bend community that received early-season treatment in 1950. In spite of the fact that 1947 is considered the best year in the last ten for cotton production in McLennan and Falls counties, and in spite of the fact that in 1949 one-third of the farmers in the Bolton Bend area greatly increased their production by practicing early-season insect control, the average yield per acre in 1950 was 22 percent higher than in 1947, 63 percent higher than in 1948, and 34 perecent higher than in 1949.

As already stated, two farmers in the Bolton Bend area used no insect-control measures in 1950. On strictly comparable land and cotton, on June 23 the untreated cotton averaged 63 percent punctured squares as compared with 5 percent on the 15 nearby farms that had received early-season insecticidal treatments. The average yield on these two untreated farms was 200 pounds of lint per acre as compared with 306 pounds on the 15 treated farms, a gain for the treated cotton of 53 percent.

Every field that was included in the untreated check area of the Satin community in 1949 was in the treated area of the Satin-Asa community of 1950. The average production of the untreated cotton in 1949 was 185 pounds of lint per acre, whereas on these same farms in 1950, cotton that received 3 early-season treatments produced an average of 434 pounds per acre, an increase of 135 percent.

The 7 untreated fields of the Bolton Bend community of 1949 produced 172 pounds of lint cotton per acre. In 1950 these fields received 3 early-season treatments and no late-season treatments, and the production was 406 pounds of lint per acre, an increase of 136 percent.

Several cotton growers in the Satin-Asa community have been farming the same land for 20 years or more. These growers produced more cotton per acre in 1950 than during any of the past 20 years, and many of them spent far less money for poison. The community average on the 21 farms was much higher in 1950 than in any of the last 20 years. This could not be due to increased fertility of soil, because legumes and commercial fertilizers have not been used to any extent in this area. The farmers in the Satin-Asa community all give a large part of the credit for this exceptionally high production to early-season control of insects.

The grade of cotton was also much higher than usual. Over 80 percent of the cotton graded strict middling and 90 percent graded middling or better. The Lankart gin, which gins most of the cotton from the Asa-Satin community, was complimented in early September by the Bureau of Census and the Cotton Branch of the Production and Marketing Administration because during August it had ginned more bales of cotton and the cotton ginned had the highest grade of any of the 450 gins in 29 central Texas counties.

Summary

All cotton on adjoining farms in two communities near Waco, Texas, received

three early-season applications of insecticides for control of cotton insects. A total of 3,602 acres was treated on 36 farms. Most of the sprays consisted of toxaphene emulsions, and were applied by low-gallonage, low-pressure ground machines. Sprays were used on 93 percent of the acreage and dusts on 7 percent.

The dates of the applications ranged from May 21 to June 15. The communities were sufficiently large and isolated that the early-season applications gave entirely satisfactory control of the boll weevil (*Anthonomus grandis* Boh.) on 90 percent of the acreage.

No midseason poisoning was done. No late-season treatments were made for control of the bollworm (*Heliothis armigera* (Hbn.)), and no damage was done by this insect. Beneficial insects were plentiful in all fields, and are known to have prevented serious damage in at least one field where bollworm infestations were threatening.

Early-season treatment accelerated early fruiting to the extent that treated cotton matured and was harvested 2 to 3 weeks earlier than the untreated cotton. It was therefore possible to destroy the cotton stalks early. Most of the stalks were destroyed by September 30, and nearly all of them by October 15. The elimination of insect damage also resulted in a higher grade of cotton.

In the two communities the average production of lint cotton per acre was 474 pounds from the treated and 270 from the untreated cotton, a gain of 76 percent. The net profit was $74.84 per acre, or $269,575 on the 3,602 acres.

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tervals with calcium arsenate at 7 to 10 pounds per acre. The 3-5 mixture is apparently safe to use in fields with geese. Bees attending cotton have not been destroyed by it, as is the case with calcium arsenate. If washed off in less than 10 hours, repeat immediately; from 10 to 24 hours repeat the third day.

Mississippi—Acres covered by one gallon of concentrated insecticide and the amount of water required for dilution when number 1G nozzles are used or when 1 gallon per acre per nozzle is applied.

Insecticide	Lbs. Poison per gallon	Water per gallon of concentrate	Poison per acre 3 nozzles	Acres covered with nozzles per row		
				1	2	3
Aldrin	2.0	23	0.25	24	12	8
Dieldrin	1.5	29	0.15	30	15	10
DDT	2.0	11	0.5	12	6	4
Gamma BHC	1.2	8	0.4	9	4.5	3
" "	1.6	11	0.4	12	6	4
Toxaphene	6.0	6.2	2.5	7.2	3.6	2.4
" "	8.0	8.6	2.5	9.6	4.8	3.2
Tetraethyl Pyrophosphate (TEPP)	2.0	59	.1	60	30	20
" " " " "	4.0	119	.1	120	60	40
Chlordane	6.0	17	1.0	18	9	6
" "	8.0	23	1.0	24	12	8

2. Aldrin (118). A dust containing 2.5% aldrin at 10 pounds per acre will control the boll weevil, the cotton fleahopper, tarnished plant bug, rapid plant bug, and thrips. Thrips and fleahoppers may be controlled with as little as 5 to 8 pounds per acre. Generally aphids do not build up following its use. Hatching leafworms are killed by it but it does not control large leafworms. Bollworms may be controlled by a mixture of 2½% aldrin and 5% DDT. Aldrin is compatible with all of the new organic insecticides recommended for cotton insect control. If washed off in less than 10 hours repeat immediately; from 10 to 24 hours repeat the third day.

3. Toxaphene. A dust containing 20% toxaphene at 10 to 15 pounds per acre will control the boll weevil, fleahopper, thrips, grassworm, leafworm, cutworm, grasshoppers and rapid and tarnished plant bugs. Toxaphene at 10 pounds per acre is fairly effective against moderate infestations of the bollworm, but in heavy infestations increasing the dosage to 15 to 20 pounds per acre or the addition of 2½% DDT is desirable. Thrips and fleahoppers may be controlled with as little as 5 to 8 pounds 20% toxaphene per acre. The cotton aphid will not develop injurious infestations if toxaphene is used throughout the season. It will not control heavy aphid infestations and should not be alternated with calcium arsenate because of the danger of aphid increase. If washed off in 24 hours it should be repeated.

4. Dieldrin (497). A dust containing 1½% dieldrin at 10 pounds per acre will control thrips, cutworms, the boll weevil, the cotton fleahopper, tarnished plant bug and rapid plant bug. Thrips and fleahoppers may be controlled with as little as 5 to 8 pounds per acre. Aphids do not usually build up following its use. Bollworms may be controlled by a mixture of 1½% dieldrin and 5% DDT. Dieldrin is compatible with the other organic insecticides recommended for cotton insect control. If washed off in 24 hours it should be repeated.

5. Lime-free calcium arsenate-½% to 1% parathion. This mixture of lime-free calcium arsenate and parathion at 10 pounds per acre has given good control of the boll weevil and prevented infestations of lice and red spiders. Fairly heavy infestations of lice may be controlled if the mixture contains 1% parathion and is applied in the late afternoon. Morning applications will be less effective.

Liquid Insecticides Suggested for 1951

Emulsifiable concentrates of toxa-

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Cotton Insect Control Calendar for Mississippi

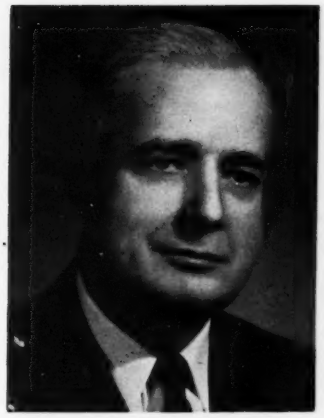
Early Season Control

Insect	Begin Treatment	Dusts and Lbs. Per Acre	Sprays & Nozzles per Row	Repeat
Cutworms	When worms appear	10% DDT, 20% Toxaphene or 1.5% dieldrin-10 lbs.	Toxaphene, dieldrin or DDT 1 Nozzle	When necessary
Thrips	Two-leaf stage or later if needed	20% Toxaphene, 2½ aldrin, 1.5% dieldrin, 5% DDT or 3-5-0 (BHC & DDT) 5-8 lbs.	Toxaphene, dieldrin, aldrin, DDT or GBHC 1 Nozzle	7 days
Boll weevil, Fleahopper	At first squaring if insects present	20% Toxaphene, 3-5-0 (BHC & DDT), 2½% aldrin, 1½% dieldrin, 5-8 lbs.	Aldrin, dieldrin, GBHC, or toxaphene, 1-2 Nozzles	Weekly 3 or 4 applications

Late Season Control

Boll weevil	10-15% Infestation	Same as above 10-15 lbs. calcium arsenate 10 lbs.	Dieldrin, aldrin, GBHC or toxaphene 3 Nozzles	4-5 day intervals
Bollworm	When 10% of terminal buds are damaged	10% DDT, 3-5-0 (BHC & DDT) 2½-5-0 (aldrin & DDT), 1½-5-0 (dieldrin & DDT), 20% toxaphene	Add DDT to above at rate of .25 to .5 lb. per acre 3 Nozzles	4 to 5 days or as needed
Leafworm	When worms appear	20% Tox., 3-5-0, Cal.Ars. 10-15 lbs.	Toxaphene, GBHC 3 Nozzles	As needed
Aphid	At first honeydew	3-5-0 .5 to 1.0% parathion	GBHC or TEPP 3 Nozzles	As needed
Tarnished and Rapid plant bug	When damage first appears	Same as for boll weevil except calcium arsenate	Same as for boll weevil	As needed
Fleahopper	10 to 35 per 100 terminals	Same as for boll weevil except calcium arsenate	Same as for boll weevil	As needed
Red Spiders	When numbers present	Sulphur 20-30 lbs. or 1% parathion	TEPP 3 Nozzles, .1 to .3 lbs.	5-7 days
Grasshoppers	When damage occurs	2.5% aldrin, 1.5% dieldrin, 20% toxaphene, 10% chlordane, 10 lbs.	Aldrin, dieldren, toxaphene or chlordane, 3 Nozzles	As needed

THE PINK BOLLWORM PROBLEM



L. F. CURL

By L. F. CURL

THE PINK BOLLWORM is not a problem that is of concern only to presently infested areas—it is one that must be faced by all cotton-growing states.—ED.

THE PINK BOLLWORM is a problem facing not only the cotton growers of infested areas in the southwestern part of the United States and adjacent areas of Mexico, but it is a problem to be met in all the cotton-growing states. This is evident from recent developments in south Texas, where in Nueces County, with a previous history of no losses from the pink bollworm, some fields were severely damaged in 1950. The pink bollworm has been recognized by entomologists in many parts of the world as the most destructive insect pest of cotton, but we in this country now know from experience how serious this pest is.

Many growers in south Texas have come to recognize the fact that, without vigorous enforcement of mandatory controls, pink bollworm infestations will build up rapidly and cause losses that will quickly exceed those due to the boll weevil and other cotton insects. For many years, up to and including 1949, inspectors went into the fields in Nueces County each spring as soon as the cotton plants began to bloom. Because adequate cultural practices had been rigidly adhered to, they found no pink bollworms in early blooms except for a single infested bloom in each of three fields in 1948. During the fall of 1949 cotton fields in that county were not destroyed in accordance with the established deadline of September 25 for destruction of the stalks. Owing to a combination of circumstances, including weather favorable for the production of a top crop and unfavorable for destruction of the stalks, cotton was allowed to fruit in Nueces County during October and November. It is true a few thousand bales were produced even though the stalks had not been destroyed on schedule. In 1950, however, the growers in Nueces and other Texas counties suffered much greater loss, and in view of the spread of infestation the losses will continue for a number of years in the newly infested counties. The early inspection of

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DESTRUCTION of Cotton Stalks for Pink Bollworm Control. One of the most acceptable methods of pink bollworm control is the use of a roller stalk cutter, shredder, or other type of equipment. In this instance the roller stalk cutter is followed by a tandem disk which cuts the cotton stalks into still smaller pieces. Photograph was made in Nueces County, Texas late in August last year.

blooms in 1950 quickly revealed the presence of the pink bollworm. More than 75 per cent of the fields inspected in Nueces County were found to have infested blooms. From these early infestations there was a considerable build-up of pink bollworms in many fields in Nueces County. Examination showed that in some fields the pink bollworm had damaged in excess of 50 per cent of the bolls, making them non-pickable. These conditions were viewed with alarm by many growers, and cotton stalks in the infested fields were destroyed by August 31, three weeks in advance of the mandatory deadline.

Infestation spread from Nueces County by flight or wind carriage of the moth to other counties under pink bollworm quarantine in south Texas very early in the crop season. This provided an additional springboard for their movement by natural means into areas in central and northern Texas that previously had been free from the pink bollworms. The pink bollworm also reappeared in practically every county in northwest Texas and in southwest Oklahoma, including four additional counties in that state. Much of the area in northwest Texas and the entire Oklahoma area had been free from infestation in 1948 and 1949 and, in accordance with the pink bollworm quarantine policy, would have been released from regulation had the area been free of infestation during 1950. Considering the tremendous cost of treating products in infested counties, it is evident that the spread of the pink bollworm in 1950 proved to be very expensive.

In the Lower Rio Grande Valley infestation in the 1950 crop exceeded that in the previous crop. However, all the stalks in Cameron, Hidalgo, and Willacy Counties, where stalk destruction is required by August 31, were destroyed on schedule. A much lower population of pink bollworms went into hibernation than in the previous year. However, there has been practically no moisture either in the Lower Rio Grande Valley of Texas and Mexico or in south Texas since stalk destruction was accomplished. Consequently, survival of this reduced number of pink bollworms has been high, as evidenced by inspections of field debris beginning early in December and continuing through January 26. The only hope of any additional reduction in carry-over is for these areas to receive moisture in the near future, which would cause some hibernating worms to complete their life cycle and the moths to emerge before there is any fruiting cotton upon which to deposit their eggs. In other words, the pink bollworm carry-over and initial infestation of the new cotton crop is dependent upon weather conditions during the next few weeks.

The reinfestation of several parishes in southwestern Louisiana again focuses attention upon the fact that the pink bollworm is not and never has been a problem confined to the border areas of the United States and Mexico. As the result of aggressive measures adopted by the Louisiana Department of Agriculture and the Federal Bureau of Entomology and Plant Quarantine, the pink bollworm was eradicated in Louisiana on two previous occasions. Plans are now under way to invoke a noncotton zone in all of Cameron Parish and a portion of Vermillion Parish in an effort to eradicate the infestation in Louisiana a third time. Strict regulations will be required in connection with cultural practices, treatment of cottonseed, sanitation at gins, as well as any other measures which will contribute to its accomplishment. Fortunately, the noncotton zone in southwestern Louisiana will not take much more than 1,000 acres out of cotton production. This rigid measure of control is recognized as being essential under the circumstances.

Georgia, Alabama, and South Carolina, in addition to the threat of pink bollworm invasion from the southwest, are also faced with the hazard of infestations in wild cotton spreading to their cotton fields. Fortunately, wild cotton eradication work was resumed before the pink bollworm had spread from the Florida Keys and the Cape Sable area northward along the west coast around Fort Myers and Tampa, where wild cotton is much closer to cultivated cotton than on the Florida Keys. Examination of material removed from plants destroyed in the Fort Myers-Tampa area indicates the absence of infestation for the current work season.

In the quarantined areas in Arizona, New Mexico, Oklahoma, Texas, and Louisiana, cottonseed, before being released into channels of trade, must be treated with heat or with methyl bromide to kill all the pink bollworms present. There is no record of spread of infestation through the movement of cottonseed that has been treated for this purpose under Federal-State supervision. Approximately 75 per cent of the registered cottonseed breeders in Texas now operate under pink bollworm regulations, and many of them have been treating their seed for years. This seed is safe for planting anywhere, and thousands of shipments have been made into nearly every cotton-producing state. There is no record of any such shipment being responsible for pink bollworm spread. As an added precaution, a number of counties along the Mexican border are designated as heavily infested, and cottonseed moving out of those counties must be given a second treatment with either heat or methyl bromide.

Reduction of the pink bollworm infestation is of concern to growers, ginners, and other processors and handlers of cotton. The enforcement of control and regulatory measures is the direct responsibility of the Bureau of Entomology and Plant Quarantine in cooperation with the affected states. We have endeavored to give information pointing to the tremendous importance of controlling pink bollworm infestations. There is no doubt whatever that the Lower Rio Grande Valley and adjacent area of Mexico and south Texas will continue to serve as breeding grounds for this insect. Whether the infestation is held down or builds up will be directly reflected in spread or prevention of spread of the pink bollworm to other areas. It is necessary to have the active cooperation of every grower, every processor, and every governmental agency in the United States and in Mexico, if we are to prevent another spread such as occurred in 1950.

If the pink bollworm infestation can be reduced and held at a minimum in the Lower Rio Grande Valley of Texas and Mexico and the remainder of south Texas, it is believed that the quarantine lines can be moved further south in the not too distant future, for whenever the infestation has been held at an extremely low level at these focal points, there has been little reinfestation in the more northern counties in Texas and southwestern Oklahoma.

Virginia Ginners to Get Technical Assistance

Announcement was made this week by Fred P. Johnson, cotton ginning and marketing specialist of the North Carolina Department of Agriculture, that technical assistance is now available to Virginia ginners from the Department. Arrangements were completed by the commissioners of agriculture of the two states. It was felt that because of similar conditions existing in Virginia and North Carolina it would be desirable for the ginners to develop their services along parallel lines.

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phene, aldrin, dieldrin, benzene hexachloride, chlordane and DDT, as well as combinations of these, will be available in 1951. The amount of insecticide will vary from 1½ to 8 pounds of toxicant per gallon, therefore the grower should know the actual pounds present to determine the quantity to use per acre. The amount of spray per acre will vary with the type, make and speed of equipment. With tractor-mounted equipment, 1 to 3 gallons per acre will usually give good control. It is necessary to use small hollow cone nozzles delivering 1 gallon of liquid per hour at 40 pounds pressure. The angle of spray from the nozzle should not be more than 70 degrees. Tractor speeds should vary from 3 to 5 miles per hour, depending on the size of the cotton. Fender guards should be used on all tractors in late-season spraying.

1. Toxaphene. This should be used at rates varying from 0.80 pounds per acre for thrips and cutworms on cotton just out of the ground to 2½ pounds technical material per acre for weevils in July and August. For bollworms add ¼ pound technical DDT per acre. Concentrates containing 8 pounds per gallon are suggested.

2. Aldrin (118). For thrips on cotton just up, only 0.80 pound per acre is required but this should be increased to ¼ pound per acre by July for boll weevil and other pests. For bollworms add ½ pound technical DDT per acre. Concentrates containing 2 pounds per gallon are suggested.

3. Dieldrin (497). Dieldrin should be used at rates of 0.05 pound per acre for thrips; 0.10 pound for cutworms and early weevil control; and 0.15 to 0.20 pound per acre for regular summer boll weevil control in July and August. For bollworms add ½ pound technical DDT per acre when needed.

4. Gamma benzene hexachloride. Use this material at rates varying from 0.10 pound per acre with a single nozzle at 30 pounds pressure for thrips and cutworms on seedling cotton to 0.40 pound per acre with 3 nozzles at 40 pounds pressure in July for weevil control. For bollworms add ½ pound technical DDT per acre. Concentrates containing 1.6 pound per gallon are suggested.

5. Tetraethyl pyrophosphate (TEPP). This is suggested for lice and red spiders at the rate of 0.10 to 0.20 pound per acre in ground machines. A concentrate containing 4 pounds of the technical material per gallon is suggested.

6. DDT. When bollworm control becomes necessary emulsions containing DDT should be added to sprays for boll

weevil control or used alone at a rate of one-half pound technical DDT per acre except with toxaphene in which case only one-fourth pound DDT per acre is needed.

Other Insecticides

1. Chlordane. Chlordane has been effective against the boll weevil in some states but has not given consistent control throughout the Cotton Belt. In Mississippi, a dust mixture containing 1% gamma BHC, 5% chlordane and 5% DDT has given satisfactory control of the major cotton insects. In late season a rate of 12 to 15 pounds per acre is necessary.

As a spray, this should be applied at the rate of 3/10 pound technical chlordane per acre for thrips and cutworms on cotton just up and 1 pound per acre in mid-summer and late season for boll weevil and other insects. For bollworms add ½ pound technical DDT per acre.

2. Heptachlor. This is a new material which has been tested extensively only during 1950. It is highly effective against the boll weevil and most other cotton pests, except the cotton aphid, bollworms, and red spider mites. It kills a high percentage of weevils in squares and is considered very promising for cotton insect control. Dosage levels have not been determined for each insect but its use during 1951 is suggested on an experimental basis at the rate of 1/3 to ½ pound per acre of the technical material, either in dusts or in sprays. This material should be handled with caution until more is known about its effects on man.

Recommended Sprays for Cotton Insect Control in Missouri—1951

Insect	Insecticide and Rate per Acre* (Use emulsifiable concentrates only)	When to Apply and Remarks
Aphids "Plant-lice"	BHC at 1/3 lb. of gamma isomer per acre OR lindane at 1/3 lb. OR nicotine at 3-5 lbs.	Same as for dusts. Add toxaphene or DDT for mid-season and late season bollworm control.
Army worms and Cutworms	Toxaphene at 2-3 lbs.	Same as for dusts.
Boll Weevil	Toxaphene at 2-3 lbs. OR toxaphene plus DDT at 1-2 lbs. of toxaphene and ½ to 1 lb. of DDT	Same as for dusts.
Bollworm	Toxaphene at 2-3 lbs. OR toxaphene plus DDT at 2-3 lbs. of toxaphene and 1-2 lbs. of DDT OR DDT at 1-2 lbs.	Same as for dusts.
Fleahoppers Lygus Bugs Stink Bugs Rapid Plant Bugs Thrips	Toxaphene plus DDT at ½ lb. of toxaphene and ¼ lb. of DDT	Same as for dusts.
Grasshoppers	Toxaphene at 2-2½ lbs. OR chlordane at 1-1 ½ lbs. OR BHC at 1/3 to ½ lbs. gamma isomer	Same as for dusts. See your County Agent for other grasshopper control recommendations.
Leafworm	Toxaphene at 2 to 3 lbs.	Same as for dusts.
Red Spider Mites	Compound 88R at ½ to 1 lb.	Same as for dusts.
Garden Webworms	Toxaphene at 2 to 3 lbs.	Same as for dusts.

***Note:** The amounts per acre listed above refer to the technical material, thus toxaphene at 2 to 3 pounds means 2 to 3 pounds of the actual or technical toxaphene per acre. This amount varies with the different formulations of the various chemical companies.

Recommended Dusts for Cotton Insect Control in Missouri—1951

Insect	Insecticide and Rate per Acre	When to Apply and Remarks
Aphids "Plant-lice"	3% nicotine at 10-15 lbs. OR 3-5-40 mixture at 10-15 lbs. OR 3% gamma BHC at 10 lbs. (Add 10 lbs. of 10% DDT for Bollworms)	When curled leaves or honeydew or both appear. **NOTE:** to avoid bollworm trouble, do not use BHC alone in mid- or late season.
Armyworms and Cutworms	20% toxaphene plus 40% sulfur at 10 to 15 lbs.	When one or two worms per linear foot of row are present or when migration into cotton begins.
Boll Weevil	20% toxaphene plus 40% sulfur at 10-15 lbs. OR 3-5-40 mixture at 10-15 lbs. OR Calcium arsenate at 10-15 lbs.	When 25 bolls per hundred plants show infestation. Repeat at 4-5 day intervals until control is obtained.
Bollworm	10% DDT plus 40% sulfur at 10-15 lbs. OR 20% toxaphene plus 40% sulfur at 10 to 15 lbs. OR Calcium arsenate at 16 lbs.	When eggs and 4 or 5 worms are found for every 100 plant terminals examined.
Fleahopper Lygus Bugs Rapid Plant Bugs Stink Bugs Thrips	10% toxaphene plus 40% sulfur at 10-15 lbs. OR 5% DDT plus 75% sulfur at 10-15 lbs. OR 3-5-40 mixture at 10-15 lbs. OR sulfur at 15 to 20 lbs.	When 25-30 bugs per 100 terminals are present.
Grasshoppers	20% toxaphene plus 40% sulfur at 10-15 lbs. OR 10% Chlordane at 10-15 lbs. OR 3% gamma BHC at 10-15 lbs.	When 4-5 hoppers per square yard are present. See County Agent for other grasshopper control recommendations.
Leafworm	20% toxaphene plus 40% sulfur at 10-15 lbs. OR 3-10-40 mixture at 10-15 lbs. OR Calcium arsenate OR Lead arsenate } at 10-15 lbs. OR Paris Green	When leafworms appear early, time applications to hit newly hatched worms of second brood.
Red Spider Mites	Sulfur at 20 lbs. OR 5% Compound 88R ("Aramite", "Aramex", etc.) at 10 lbs.	When reddening and curling of leaves or webbing or mites appear.
Garden Webworms	20% toxaphene plus 40% sulfur at 10-15 lbs. OR 3-5-40 mixture at 10-15 lbs. OR Calcium arsenate at 10-15 lbs.	When worms and webbing appear.

For detailed discussion of biology and control of these and other cotton insect pests in Missouri see Mo. Agr. Exp. Sta. Bulletin No. 545 "Cotton Insects and Their Control in Mo."

Control of Insects in—

• Missouri

In the first section of the table at left, which deals with recommended sprays for insect control in Missouri, the amounts of material recommended per acre refer to the technical material; thus toxaphene at 2 to 3 pounds means 2 to 3 pounds of the actual or technical toxaphene per acre. This amount varies with the different formulations of the various chemical companies.

For a detailed discussion of biology and control of these and other cotton pests in Missouri, see Missouri Agricultural Experiment Station Bulletin No. 545: "Cotton Insects and Their Control in Missouri."

(See tables of Missouri recommendations at left.)

Control of Insects in—

• New Mexico

Insect damage is one of the most important factors limiting cotton production in New Mexico. A sound cotton program leads to balanced production, lower cost, better cotton and higher profits. Insect control is one of the important steps in such a program. Experiments have shown that the use of chemicals is the only means practical and effective in reducing insect infestations on cotton, once they are present. The efficient use of poisons for cotton production involves three important limitations—*application of the right poisons at the right time and in the right way.* It is important to remember that poisons must cover the plants to kill insects. When plants put on new growth, or the poison is washed off, plants are no longer protected.

The grower should remember that the responsibility for controlling insects rests squarely on his shoulders.

Three important phases of control are recognized:

1. Early season control.
2. Late season control, based on infestation.
3. Early stalk destruction and farm cleanup.

The recommended practice is to carry out the complete program for greatest benefits.

Early Season Control

Early season control insures early fruiting and earlier maturity in those areas of the state where aphids, thrips, fleahoppers or lygus bugs, alone or in combination, cause damage every year.

The number of applications required depends upon the severity of infestation. Applications should be made at 7-day intervals until effective control is obtained.

In some areas of the state, damage due to thrips, aphids, fleahoppers and lygus is rather severe. These areas will require several applications, beginning when the cotton is in the 4-leaf stage. However, it may often be necessary to treat earlier, to prevent loss of stand by darkling ground beetles, cutworms, armyworms, thrips, or aphids.

Regardless of the number of applications in the early season program, the last should be made at least 30 days before the bollworm usually appears, unless infestations of early season pests are extremely heavy. This period is desirable to allow time for beneficial insects to build up in sufficient numbers to give some protection against bollworms. Individual fields or farms may receive considerable benefits from early season control, but it is most effective when practiced on a community or county-wide basis. The larger the area treated, the greater the benefits.

Experiments in other states show that sprays have given more effective and more economical control of insects attacking young cotton than dusts. Because of the small size of the plants, a greater concentration of the insecticides is obtained from a spray. Frequently, effective spraying can be accomplished at times during the day when dusting is ineffective.

Late Season Control

Regardless of whether early season control was followed or not, late season control should be followed when insect infestations warrant it. The number of applications needed for control varies according to the infestation and amount of injury. Other points to be taken into consideration are the growing conditions of the plant and the available moisture. There is no point in applying insecticides if cotton is not growing or able to put on fruit, except for late applications for boll protection.

Be sure insect populations in the field are high enough to demand insecticide application and do not make application because someone else in the vicinity is doing so. Each grower should be able to identify insects, make his own counts, and evaluate the damage in order to properly control insects. The effectiveness of an insect control program depends upon the proper use of recommended insecticides. *They must be properly applied at the right time.*

For late season control to be successful, treatment should begin when recommended and continue at 5 to 7-day intervals as long as infestations make it necessary. Dosages should be increased with the size of the plant and severity of the infestations. Because of an expected shortage of insecticides in 1951, the table on page 101 contains all effective combinations of insecticides, and not necessarily preferred insecticides. (See table for specific control recommendations.)

Early Stalk Destruction and Farm Cleanup

Kill cotton stalks as soon after the cotton is harvested as possible. Stalks may be killed by cutting, plowing under, or heavy grazing by livestock. This practice will destroy an important source of food for many cotton pests during the late fall months. Ditch banks, fence rows, and other overwintering quarters should be kept free of weeds and other debris that harbor insects. Clean up such places by mowing or discing or with a stalk cutter so as not to create an erosion problem.

Clean cultural practices aid in reducing threatening infestations of pink bollworm. The Pink Bollworm Division of the Bureau of Entomology and Plant Quarantine recommends cultural practices including early stalk destruction on a community-wide basis and regulated planting dates for the control of this pest. A supplemental control for this insect is the use of 2% gamma BHC—10% DDT—40% sulfur or 10% DDT—40% sulfur at 15-20 pounds per acre. Sprays containing 2 to 3 pounds of DDT per acre are also effective. The Extension Service urges support of the pink bollworm regulations.

Infestation Counts

If insecticides are to be used profitably, they must be applied at the right time. Late season control recommendations are based on infestation counts.

Fleahopper, Lygus, Superb Plant, and Stink Bug:

1. Make weekly examinations. Begin when cotton is mature enough to make squares.

2. Make 100 sweeps with a 16-inch net at five representative points in the field. Count number of insects collected at each point. Average per 100 sweeps indicates infestation.

Bollworm

1. When most of the corn silks in area

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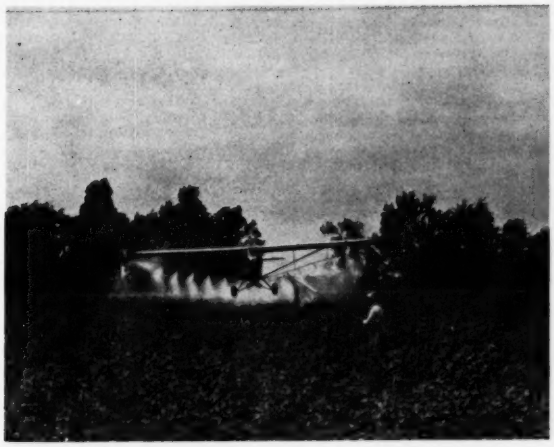

GREAT PROGRESS has been made in recent years in the application of poisons by airplanes. Spraying the new insecticides from the air is an effective method of control and is becoming more popular each year.

PROGRESS IN CONTROL OF COTTON INSECTS

By D. GRAY MILEY

STONEVILLE is one of our key cotton insect control research centers. Doctor Miley and his staff at the Delta Branch Experiment Station, in cooperation with USDA entomologists and agricultural engineers, have made many important contributions to our present knowledge of the subject of how to control cotton pests effectively and economically.

THE DISCOVERY of synthetic organic insecticides and the subsequent development of ways and means of using them effectively to control cotton insects have brought about some revolutionary changes in the approach to this important problem. The search for more effective insecticides and more efficient methods and machines for use in the control of cotton insects has been going on since 1892. This is the year that the boll weevil entered the United States.

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Information reported in this article has been obtained from research conducted by Dr. E. W. Dunnam and Mr. S. L. Calhoun, Entomologists, Bureau of Entomology and Plant Quarantine, and Mr. W. E. Meek and Mr. O. B. Wooten, Engineers, Bureau of Plant Industry, Soils, and Agricultural Engineering, in cooperation with Delta Branch Experiment Station, Stoneville, Mississippi.

During the early history of research on the control of the boll weevil, cultural practices were the only means available to control this insect. Some of the cultural practices, such as fall stalk destruction, early planting, the use of early-maturing varieties, and thorough cultivation and fertilization, are just as useful today as they were when the boll weevil first became a serious pest. During the intervening years, many improvements have been made in the machines used for cultivation and stalk destruction.

Early attempts to control the boll weevil with chemicals were very discouraging. The first insecticides were applied as sprays with very crude equipment and were accompanied by very poor results. Materials such as Paris green and lead arsenate, when applied as sprays, killed some boll weevils; but the control was not sufficient to give any significant increase in cotton yields. As early as 1908 powdered lead arsenate was used with some success, but the results were not uniform, and the material was never used extensively. The discouraging results obtained in these early experiments with chemicals led several investigators to conclude that spraying cotton was impractical. They came to the further conclusion that because of the fact that the boll weevil spends all stages of its life cycle except the adult stage within the fruit of the cotton plant, it was not reasonable to believe that control could ever be obtained with chemicals. There is very good reason to believe that this attitude on the part of these early investigators delayed progress in finding insecticides that would control the boll weevil. It was 28 years after the boll weevil entered this country before chemical control was commercially available.

Research work which was conducted in 1915 demonstrated that calcium arsenate dust could be used as an effective boll weevil insecticide if applied at the proper time and under the proper conditions. This material found ready acceptance, and within 4 years after the first research was completed, over 3 million pounds of calcium arsenate dust were used. This amount increased steadily, and the annual use has been between 60 and 70 million pounds until recent years.

Calcium arsenate was more effective as a dust and had its most extensive use in that form. It killed only as a stomach poison and therefore had to be ingested by the adult weevil. The fact that calcium arsenate was most effective as a dust led to intensive research to develop machinery for the efficient application of this material. This research resulted in the development of many types of dusting equipment. Much of this equipment was designed for specific purposes and resulted in several types of machines. The more common of these were the rotary type hand gun; the sad-

D. GRAY MILEY

dle gun; the two-nozzle traction machine; the power-operated, multiple-nozzle, cart machine; and the tractor-operated machines with five to eight nozzles. The development of these many types of dust applicators was natural, since the arsenical insecticides available were more effective as dusts than as sprays. Apparently there was no concerted effort on the part of anyone to develop spray machinery.

The early investigators found that dusts did not give effective control if applied when there was any appreciable wind movement. This led to the practice of applying dusts in the late afternoon, at night, or very early in the morning. Because of this "off" hour operation, dusting has always been a disagreeable task for the farmer, and it is apparent that insect control has often suffered because of the reluctance on the part of the farmer to apply dusts at the time they were most effective.

The successful use of the airplane to apply insecticides was undoubtedly one of the greatest advancements in insect control methods made since the boll weevil became a serious problem. The use of airplanes on a commercial scale, which began in 1924, made it possible for almost all of the large farmers to get fairly good insect control. The equipment that was developed for use with the airplane was all designed to give effective coverage with dusts. The airplane could cover large acreages in a relatively short time and made it possible for farmers to get their insecticides put out in late afternoon or early morning. The airplanes used the same calcium arsenate in dust form that had been used in the ground equipment.

It is significant to note that calcium arsenate was the only effective insecticide available commercially for boll weevil control for a period of about 28 years, extending from 1920 to 1947. Throughout this entire period, the development of machinery and methods for control of cotton insects centered around the efficient use of the one material—calcium arsenate. The most common practice was to wait until boll weevil infestation reached about 25 percent before applying any insecticide. With only one material available, this practice had a very sound foundation and was used with considerable success over a period of several years. Since calcium arsenate killed boll weevils only by ingestion, the proper time to apply this material was when the boll weevil population became large enough to do serious damage.

During the past 5 years, the availability of several new insecticides has changed this situation. Soon after the close of World War II, many research workers in private and governmental agencies started development and testing some of the new organic insecticides to see if they could be used to give effective control of cotton insects. The first tests were very encouraging and have been followed by a large volume of research during the last 4 years. This research has continually added new methods and materials until now the cotton producer has the most imposing array of weapons ever made available for the control of cotton insects.

Some of the synthetic organic insecticides that are now available for insect control are DDT, benzene hexachloride, toxaphene, chlordane, aldrin, dieldrin, and heptachlor. All of these materials can be made into dusts for application in that form, and they are also soluble in many of the common solvents; and when combined with an emulsifier, produce a concentrated emulsifiable liquid which, when added to water, makes an excellent spray material.

Soon after the first of these new materials were made available, members of the staff of the Delta Branch Experiment Station, Stoneville, Mississippi, started research to see if they could be used to control cotton insects. It was found that some of the synthetic organic insecticides were very effective and could be used efficiently and economically to control almost all insects that attack cotton. Most of these materials kill insects by contact, by fumigation, and by ingestion. They are usually faster acting than calcium arsenate and generally do not retain their toxicity over as long a period.

Almost all the developments in the production of synthetic organic compounds and emulsifiable concentrates were brought about as a result of efforts of research chemists during and after World War II. They were paralleled by the research of entomologists in discovering the usefulness of each material in insect control. At the same time the engineers in both state and private agencies were faced with the problem of providing machines for their application. This made it necessary for a team of workers composed of chemists, entomologists, and engineers to pool their efforts and develop materials, methods, and machines that would result in an

effective and economical program for insect control.

As this work progressed, it was found that the old system of waiting until the weevil infestation was at least 25 percent before starting the application of insecticides was not the most practical program to follow. It was found also that almost all of the organic insecticides are as effective as sprays as they are as dusts. Still further experimentation demonstrated that a very small amount of concentrated emulsion properly applied would give better control of cotton insects than the once generally accepted method of completely saturating the cotton plant. It was with this background that the low-gallonage, low-pressure spray machines were developed for use in the control of cotton insects. These machines can be attached to the tractors that are commonly used for cultivation. This makes it possible to apply an insecticide at the same time the cotton is being cultivated. The development of this machine, together with the new insecticides, opened the way for the testing of many new and different systems of insect control.

The complete life history of the boll weevil had been known for a long time. It now became possible to attack this insect at a time when it is easiest to kill. After overwintering in hibernation, the boll weevil emerges during late May, June, and early July. During the period of emergence, the weevil is weak and can be killed with much smaller doses of insecticide than later in the season. It has been shown, for example, that an application of 10 pounds of toxaphene per acre will kill about 95 percent of the boll weevils in June; whereas, a similar application in September kills only about 42 percent. Similar results have been obtained with other insecticides. The weevil begins laying eggs as soon as squares appear on the cotton plant, and a new generation hatches out at about 3-week intervals during the growing season. This means that the later one waits in the season to begin a control program, the more weevils there will be to kill and the larger the dose required to give effective weevil control. Acting on this information, the entomologists reasoned that an early insect control program should be more effective than the delaying system that had been used with calcium arsenate. This led to exhaustive research to test the organic insecticides for insect control the early part of the growing season.

In the early stages of this research, the engineer could do little to assist the entomologist except in the improvement of existing hand dusters and sprayers. However, after the first tests with concentrated sprays showed that very good control could be obtained, the need for field tests on larger plots was indicated. In order to apply spray materials to large plots, it became necessary for the engineers to enter the picture and develop machines for this purpose.

As this work was extended to larger areas, one of the first attempts to apply the organic insecticides was in conjunction with the flame cultivator. A very simple tank and tube arrangement was devised whereby the concentrated insecticide could be dropped onto the hot shell of the flame cultivator burner. It was hoped that the heat of the shell would so vaporize the liquid as to give a fumigating effect in and around the cotton plant. However, it was soon found that this method did not give the desired effect.

The next attempt was to develop a low-gallonage, directional sprayer that could be used in conjunction with a regular cultivator. It was expected that this machine could be used with or without the usual tractor-cultivating equipment. However, since the interval of early-season spraying and the interval of cultivation are for all practical purposes the same, it was logical to believe that these two operations could be performed simultaneously.

Another factor that entered into this development was the accumulation of additional information about the importance of thrips damage to the cotton plants. This insect attacks the cotton plant when it is quite young and delays its development. Quite often the terminal bud is destroyed completely, and the plant is forced to continue its growth by the production of several side branches. This stunts the plant and delays its development at a very critical period. The retarded growth also makes the young plant more susceptible to diseases which frequently cause death and results in a depleted stand.

The first field tests with tractor-mounted spray machines were for thrips during the first cultivation. These tests demonstrated that excellent control could be obtained with a directional sprayer operated in conjunction with a cultivator.

The spray equipment is composed of a tank and a pump, which is connected to the power take-off, and the necessary plumbing, strainers, and nozzles to cover the same number of rows being cultivated. In these first tests the spray boom

was attached to the cultivator frame, which meant that with front-mounted cultivators the spray nozzles were ahead of the tractor operator. This system proved so satisfactory for thrips control that it was decided to continue the spray control program on the emerging boll weevils. However, by this time the cotton plants were so large that a second nozzle had to be added so that there were two nozzles for each cotton row. The first application for boll weevil control was made when the cotton began to put on squares. Excellent control was obtained, and as the plants grew in size, a third nozzle was added so as to cover more completely the growing terminals of the plant with the spray material.

It will be noted that the first season's work was carried on with the spray nozzles mounted on the regular shovel cultivator ahead of the operator. This arrangement was used on the Delta Branch Experiment Station and on a number of outlying farms with no apparent ill effects to the operator. It was felt, however, that the spray nozzles should be mounted on the rear. This would help remove the danger of fumes or even particles of spray coming in contact with the operator of the tractor.

Rear-mounted machines have some disadvantage because the operator cannot observe them as he drives the tractor. For this reason, rear-mounted machines must be simple, efficient, and capable of keeping their adjustment. With these factors in mind, the spray machine was redesigned for rear mounting. The basic supply tank, pump, and strainers used for the front mounting were retained, and a rear boom was added that would accommodate one, two, and three nozzles per row. The boom was made with vertical adjustments so that on small cotton the nozzles could be located within 6 to 10 inches of the top of the plants and, as the plants grew in size, could be raised to a maximum height which would give at least 12 inches clearance for nozzles in cotton approximately 4 feet tall.

As mentioned earlier, studies over a long period of years had shown that practically all of the overwintering weevils emerge by the early part of July. These tests proved conclusively that it is possible to control these weevils as they emerge. The last date of emergence usually corresponds closely with the last date of cultivation, which makes the control program very efficient. It simply means that in most instances the farmer can get effective boll weevil control by applying one of the new organic insecticides at each cultivation during the month of June. This can be done with the same tractor and driver that is doing the cultivation. The only additional cost for insect control is for the spray machine and the materials that are applied.

As a result of the combined efforts of a team of chemists, entomologists, and engineers, working closely with industrial concerns, the farmer has available the most economical, the greatest labor-saving, and the most satisfactory method of controlling insects yet devised.

This program is divided into three phases. The first is the application of insecticides for thrips and cutworm control during the first one to two cultivations. The second is the application of insecticides for the control of the boll weevil and other insects, beginning when the first squares appear, and ending with the last cultivation. The third phase is the application of insecticides after the boll weevil begins to migrate, which is usually about the first of August. This last phase is accomplished by the use of airplanes or ground equipment which apply either dusts or sprays, using very much the same methods as in previous years.

This system, together with the machines, is flexible enough to allow for the variations necessary to give effective control of all the major cotton insects. Fortunately, the new organic insecticides are of such nature that they can be combined to give effective control of several insects at the same time. Each of the organic compounds has a definite place in cotton insect control, but no attempt will be made to discuss the qualities and characteristics of each of these materials. This information, together with specific recommendations for the use of each material, is available from the experiment stations and extension services in each state.

State Guides

(Continued from Page 96)

begin to dry, start examinations for bollworm eggs on cotton. Continue every 5 days until crop has matured.

2. Examine the upper one-third portion of 100 cotton plants. Special attention should be given to terminal growing points.

3. If bollworm eggs are found on the terminals and/or 4 to 5 young worms are found, infestation is high enough to start treatment. When first deposited on the plant, bollworm eggs are white and about the size of mustard seed. As hatching

New Mexico Cotton Insect Control Recommendations

Early Season Control Program

Insects	Begin Treatment	Dust Program	Spray Program
Fleahopper, Lygus, and Thrips.	Four-leaf stage or earlier if necessary	5% DDT-40% sulfur, or 20% toxaphene-40% sulfur, or 3-5-40 mixture[1], or 2½% dieldrin-40% sulfur, 10-12 lbs. per acre, 7-day intervals.	Toxaphene or 2-1 mixture[2], ¾ to 1½ lbs.; or aldrin ¼ to ½ lb., or dieldrin ⅛ to ¼ lb. per acre.
Aphids	When needed	3-40 mixture[3], or 3-5-40 mixture[1], or 20% toxaphene-40% sulfur, or 1% parathion or 3% nicotine-40% sulfur mixture. 10-12 lbs. per acre.	40% TEPP[4], ½ pint; 3-5 mixture[5], 1½ lbs. per acre; or toxaphene, or 2-1 mixture[2] ¾ to 1½ lbs. per acre.
Armyworms and Cutworms	When needed	5% DDT, or 10% toxaphene, or 5% chlordane, 20 lbs. per acre.	Toxaphene or 2-1 mixture[2], or DDT 1 to 2 lbs. per acre.

Late Season Control Program

Bollworm	When eggs and/or 4 to 5 worms are found per 100 terminals	10% DDT-40% sulfur, or 20% toxaphene-40% sulfur, or calcium arsenate, or 2½% aldrin-5% DDT-40% sulfur, or 2½% dieldrin-5% DDT-40% sulfur, 15-20 lbs. per acre, 5-day intervals	2-1 mixture[2] or toxaphene, 2 to 3 lbs., or aldrin-DDT (1-2), or dieldrin-DDT (1-2), 1 to 1½ lbs. per acre, 5-day intervals.
Leafworm	When worms first appear	20% toxaphene-40% sulfur, or 3-40 mixture[3], or calcium arsenate, 15-20 lbs. per acre, as needed	Toxaphene, or 2-1 mixture[2], 2-3 lbs. per acre, as needed.
Fleahopper Lygus Superb plant bug	When 8-10 insects taken per 100 sweeps of 16" net	5% DDT-40% sulfur, 20% toxaphene-40% sulfur, 15-20 lbs. per acre, 7-day intervals	Toxaphene, or 2-1 mixture[2], or DDT. ¾ lb. per acre, 7-day intervals.
Stinkbugs	When two or more insects taken per 100 sweeps of net	20% toxaphene-40% sulfur, or 3-5-40 mixture[1], or 2-10-40 mixture[6], or 3-40 mixture[3], 15-20 lbs. per acre, 7-day intervals.	Same as for fleahopper, except 2 to 3 lbs. per acre.
Aphids	When honeydew appears	3-40 mixture[3], or 3-5-40 mixture[1], or 1% parathion, 15 to 20 lbs. per acre for "knockout"	40% TEPP[4], ½ pint; or 3-5 mixture[5] 1¼ lbs. per acre for "knockout"
Red spiders	When leaves begin to discolor.	Dusting sulfur, 25 to 30 lbs. per acre; or 1% parathion, 25 to 30 lbs. per acre as needed.[8]	40% TEPP[4], ½ pint; or aramite[7], ¼ lb. per acre as needed.

[1]3% gamma benzene hexachloride-5% DDT-40% sulfur.
[2]A spray concentrate containing 2 parts toxaphene and 1 part DDT
[3]3% gamma benzene hexachloride-40% sulfur
[4]TEPP (Tetraethyl pyrophosphate) may be used in mixtures with other sprays for aphid or red spider "knockout".
[5]3 parts gamma (benzene hexachloride)-5 parts DDT
[6]2% gamma (benzene hexachloride)-10% DDT-40% sulfur
[7]Aramite may be used in other sprays for red spider "knockout".
[8]"Follow-up" application should be made within five days to control "Hatchout" following initial treatment.

time nears, they change to a dirty white color. These eggs will usually be found scattered on the terminal portions of the plant.

4. To obtain effective control, don't lose any time in applying poisons after eggs and/or 4 or 5 worms are found. Apply poison at 5-day intervals as long as necessary.

Application

Experiments from other states show that dusts and sprays are equally effective when properly applied.

Dust applications should be made when the air is calm or nearly so. The presence of dew is not necessary. When ground machines are used, the dust nozzles should be placed 4 to 6 inches over the tops of the plants.

Spray applications may be made at any time when winds do not exceed 15 to 20 miles per hour. Spray when plants are dry so the material will stay on the leaves. Poison runs off when leaves are wet. For early season treatment with ground equipment, one or two nozzles per row, placed 6 to 9 inches over the tops of plants is sufficient. As plants increase in size number of nozzles should be increased until a maximum of three is in use. Sprays should be applied at approximately 60 pounds pressure and at a volume of 2 to 8 gallons per acre. Effectiveness of control depends upon the amount of toxicant used per acre rather than the number of gallons of spray applied per acre. As a safety measure, it is recommended that spray booms be mounted on rear of tractor.

Both ground machines and airplanes are effective for applying poison. For best results with planes it is essential to flag the swaths so that they will overlap. Increase the dosages recommended in the table by at least 50 percent when an airplane is used for making early season application.

General

Avoid planting corn in cotton fields. Corn serves as a primary host plant for the bollworm (corn earworm) and may lead to early infestations.

If possible, alfalfa and small grains should not be planted ajacent to cotton. These crops support large infestations of insects which migrate to cotton as the crops mature or are disturbed by cutting.

The inclusion of 40 percent or more dusting sulfur should be made in all dust applications to suppress red spider build-up.

Care must be exercised to avoid contamination by drift when applying insecticides near pastures, hay crops, and vegetables that are to be eaten by humans or animals.

Observe all due precautions to avoid poisoning bees and other beneficial insects through careless and haphazard use of insecticides.

Plans must be made in advance, and these plans put into action, to insure an early harvest. Planting of early-maturing varieties and early season insect control will make it possible for many farmers to complete a greater portion of their harvest before frost. Early harvest means better grades of lint and higher quality seed.

CAUTION: ALL INSECTICIDES ARE POISONS AND PRECAUTIONS GIVEN ON THE LABELS SHOULD BE STRICTLY FOLLOWED. SPECIAL PRECAUTIONS SHOULD BE TAKEN IN HANDLING TEPP AND PARATHION TO AVOID PROLONGED CONTACT WITH THE SKIN OR BREATHING THE VAPORS OR DRIFT FROM EITHER SPRAY OR DUST.

Control of Insects in—

• North Carolina

Cultural Control

The farmer can do more than "poison" his cotton to control insects. Good farm practices help to reduce these insect pests. Plant cotton on good land that is well prepared. Space closely, fertilize and cultivate according to recommended practices. One of the most important cultural practices is to harvest the crop early and to get rid of stalks immediately. This reduces the food supply of weevils left in the field, causing them to go into hibernation early or to die from lack of food. A weakened half-starved weevil stands less chance of surviving unfavorable weather conditions during the winter than does a well-fed weevil.

Cultural control practices are far more effective when carried out on community wide, or better yet, a cotton belt wide basis. It does little good for one farmer to get rid of his plants while all of his

neighbors leave theirs available to the weevils.

Dusts or Sprays?

Experiments carried out in North Carolina and in other cotton areas of the South have clearly indicated that dusts and sprays are equally effective in the control of cotton insects.

The important thing is to follow an all-season insect control program using either dusts or sprays.

There has been a great deal of interest in spraying for control of cotton insects. Spraying can be done with proper ground or airplane equipment. For small fields, ground equipment is preferred because better coverage is usually obtained. Low pressure ground sprayers have been used in various sections of the Cotton Belt with the new organic insecticides. For small plants, one nozzle to a row is usually sufficient. Larger cotton should be sprayed with 3 nozzles to each row—one nozzle from the top and one nozzle from each side.

Emulsion concentrates are diluted with water and applied at rates varying from ½ gallon to 10 gallons of spray per acre. Some foliage burn has been noted where sprays were improperly used. Emulsion concentrates should be diluted with an equal amount of water and then added to the volume of water required for spraying.

Generally speaking, the amount of actual insecticide to be applied in spray form should equal the amount applied in dust form. For example, if toxaphene is used as a 20% dust at 10 pounds per acre, 2 pounds of actual toxaphene per acre is applied. If an emulsion concentrate is used which contains 4 pounds of actual toxaphene per gallon, then ½ gallon of the concentrate per acre is to be used in each application. This amount of concentrate would be added to the proper amount of water required to spray one acre.

Fender guards should be used on all tractors in late season work to prevent injury to cotton plants.

Chemical Control

Recommended Dusts

Benzene hexachloride-DDT:—Benzene hexachloride is usually formulated as a dust containing 3% of the gamma isomer of benzene hexachloride and 5% DDT. When applied at the rate of 10 pounds per acre, benzene hexachloride-DDT dust will control boll weevil, cotton aphid, cotton fleahopper, thrips, tarnished plant bug, rapid plant bug and bollworm. It will not control red spider mites.

The persistent, musty order of benzene hexachloride makes it objectionable to some users. Benzene hexachloride cotton dust preparations are irritating to the eyes and cause a burning sensation on sweaty skin. Workers using this material should protect their eyes with a good pair of goggles, wear an approved respirator to prevent inhalation of the material and avoid wearing contaminated clothing.

Benzene hexachloride has been found to impart undesirable flavors to such crops as peanuts and Irish potatoes when present in the soil or when applied to the growing plant. When BHC is used for the control of cotton insects some of the BHC undoubtedly remains in the soil for some time. It is not yet known whether this residue is sufficient to impart off-flavors to peanuts and Irish potatoes which might be grown in rotation with cotton. Until more information is obtained benzene hexachloride is not recommended for use on land where cotton is rotated with peanuts or Irish potatoes.

Toxaphene: — Toxaphene will control the boll weevil, bollworm, thrips, cotton fleahopper, cotton leafworm, fall armyworm, and grasshoppers. It is usually applied as a 20% dust at 10 to 15 pounds per acre and gives good control of all these pests. Thrips and leafhoppers may be controlled with less material, at one-fourth of the above amount or one-half pound of actual toxaphene per acre. It is normally effective in suppressing aphid populations but may not completely control them. Toxaphene will not control red spider mites. Compared with benzene hexachloride, it has an advantage in that it is useful for control of bollworms when properly applied. Toxaphene is less irritating, ordinarily, than is benzene hexachloride. It is relatively safe to the operator but is toxic to farm animals, poultry, and especially to fish.

Aldrin-DDT:—A 2.5% aldrin-5% DDT dust will control the boll weevil, thrips, cotton bollworm, cotton fleahopper, fall armyworm and grasshoppers when applied at the rate of at least 10 pounds per acre per application. Aphids generally do not build up following its use.

Aldrin is a highly toxic material. Adequate safety precautions should be taken while handling and applying the material. Follow the recommendations on the label. These precautions include the use of an adequate respirator, thorough washing with soap and warm water after handling the material and the use of clean clothing daily.

Sulfur: — Heretofore, 40% sulfur has been recommended in combination with some of the above materials for control of red spiders. However, in view of the short supply of sulfur and since red spider injury is often not severe enough to warrant the continuous use of sulfur, it is recommended that sulfur be used only when needed. It may be applied in the form of a good grade of dusting sulfur at 20 pounds per acre.

Recommended Sprays

Emulsifiable concentrates of toxaphene, aldrin, and DDT, as well as combinations of these materials will be available in 1951. The amount of active ingredient present per gallon of concentrate will vary from 1½ to 8 pounds per gallon depending upon the insecticide and the manufacturer. It is important to follow the directions on the label so that proper dilutions may be made.

The amount of diluted spray per acre will vary with the type, make, and speed of the equipment used. With tractor mounted equipment, 1 to 5 gallons per acre will usually give good control. Good results have been obtained using small hollow cone nozzles delivering approximately one gallon of liquid per hour. The angle of spray from the nozzle should not be more than 70 degrees. Tractor speeds should vary from 3 to 5 miles per hour, depending on the size of the cotton.

Toxaphene: — 2 pounds of technical toxaphene per acre per application.

Aldrin:—0.25 pounds of technical aldrin per acre per application. For the control of bollworm 0.5 pounds of technical DDT should be used with the aldrin.

TEPP: — None of the above-named sprays will "knock out" heavy aphid or mite infestations. Tetraethyl pyrophosphate at the rate of ½ pint of the 40% concentrate per acre is effective against both aphids and mites. It can be used in combination with any of the recommended sprays. This material should be used with caution as it is highly toxic to man and domestic animals.*

*See section on precautions recommended for using TEPP and Parathion.

Other Insecticides

Calcium arsenate dust used at the rate of 10 to 15 pounds per acre is effective against the boll weevil and the leafworm. It is also effective against the bollworm when used at 12 to 16 pounds per acre and when the applications are timed correctly. Calcium arsenate is not only ineffective against red spider mites, thrips, and aphids, but a build up of these pests often results following its use. In order to overcome this disadvantage, a special low-lime calcium arsenate which is compatible with some of the new organic insecticides which are effective against mites and aphids has been developed. These mixtures contain low-lime calcium arsenate and 1-3% gamma benzene hexachloride or 1% parathion.* Calcium arsenate is *not* recommended for use on sandy soil where it may leave a toxic residue.

Dieldrin:—0.15 pounds of dieldrin per acre applied either as a 1½% dust at 10 pounds per acre or as a spray will control thrips, cutworms, boll weevil, cotton fleahopper, tarnished plant bug and rapid plant bug. It will not control bollworms.

Dieldrin is highly toxic to mammals and is readily absorbed through the skin. Extreme precautions should be exercised when handling or applying dieldrin. Dieldrin is not recommended for general use in North Carolina during 1951 and should be used experimentally only.

Heptachlor:—This material is recommended for experimental use only. Preliminary work has indicated that 1/3 to ½ pound of the technical material per acre per application applied either as a spray or as a dust will control boll weevil, thrips, fleahoppers, and cotton leafworms. It is not effective against cotton aphids, bollworms, or spider mites. This material should be handled with caution until more is known about its effects on man.

Read Before Using Insecticides

All insecticides are poisons and should be treated as such. Some of the more dangerous ones have been in use a long time and many people have learned to handle them safely. If anyone is in doubt about the dangers or the safety precautions for any insecticide, he should first get reliable information.

Know What You Are Using.

Insecticides have many trade-mark names. Read the small type under "active ingredients."

Extra Care with Parathion or TEPP (Tetraethyl pyrophosphate).

Parathion and TEPP are especially dangerous to handle and use. Unless you are willing and able to comply with the following precautions *do not use parathion or TEPP.*

The two most important precautions in handling parathion or TEPP are: (1) Avoid contact with spray concentrates and avoid breathing concentrated dusts. (2) Avoid prolonged exposure during application of either dusts or sprays. This seems to be especially true if the weather is hot.

1. *Do Not Breathe the Dust or Mist* —Wear an approved parathion mask or

North Carolina Cotton Insect Control Recommendations

Important Insect Pests	Insecticides: Dusts	Insecticides: Sprays	Application
1. Thrips	5% DDT or same as for boll weevil.	DDT (½ lb./A) or same sprays as for boll weevil	Two-leaf stage or later as needed. Apply at weekly intervals. Watch for infestation particularly following winter cover crop.
2. Boll weevil	3% BHC-5% DDT or 20% toxaphene or 2½% Aldrin-5% DDT	Toxaphene (2 lbs./A) Aldrin - DDT (¼ lbs. Aldrin/A) (½ lbs. DDT/A)	Where weevils are a problem each year make three applications; dust 6-8 lbs. per acre or spray according to directions, at 7 day intervals starting when squaring begins; make square counts and if infestation rises to 10% make 2 or 3 or more applications, using 10-15 lbs. per acre at 5 day intervals. **Do not** use **BHC** mixture if cotton will be followed by peanuts or Irish potatoes.
3. Bollworms	3% BHC-5% DDT or 20% toxaphene or 10% DDT	Toxaphene or DDT with Aldrin as for boll weevil.	Treatment for boll weevil should hold population in check. If infestation is not checked, increase dosage regular application to 15 lbs. per acre or use 2 applications of 10% DDT dust at 10 lbs. per acre at 5 day intervals. If using sprays, a special application of 1.0 lb. of DDT per acre may be advisable.
4. Red spider	Sulphur	40% TEPP (½ pint per A)	Twenty lbs. of dusting sulphur per acre should reduce infestation. TEPP is preferred as a spray. See aphids.
5. Aphids	3% BHC-5% DDT	40% TEPP (½ pint per A)	If populations develop where other dusts are used, make one or more applications of BHC-DDT as for boll weevil control.

respirator. You can get this from your parathion dealer.

Wear an approved respirator while handling concentrates and when loading dusters or sprayers.

Wear an approved respirator while dusting or spraying, and work to the windward.

Wear an approved respirator in recently sprayed or dusted areas on calm, hot days.

Keep the mask clean and change filters after 4 hours use and cartridges after 8 hours use.

2. *Keep These Insecticides Off the Skin and Out of the Eyes*—Never handle concentrated (strong) wettable powder or liquid with bare hands. If some accidentally gets on your hands, wash it off immediately with soap and warm water. Wear rubber gloves. If a drop of the concentrate should splash into the eye, rinse with water for several minutes, and see a doctor immediately. A light plastic raincoat, a rain hat, and goggles give good protection. Wash hands and face after using sprays and dusts. If dust or spray goes through clothes, take a bath. Remove all clothing and change to other clothing immediately after using parathion or upon leaving area where parathion is being used or if clothing becomes drenched with spray. Wash such clothing with soap and not water before re-use.

3. *Do Not Get Any Poisons in the Mouth*—Wash before eating or smoking. Do not store any insecticides near food or where children can reach them. Bury empty cans or bags.

What to Do in Case of Poisoning.

If any user feels sick or weak, or has blurred vision, headache, or discomfort in the chest he should avoid further exposure and see a doctor at once. The doctor should be told what material was used, or shown the label on the package. If the doctor does not know the treatment for the poison, he should phone a hospital or the State Board of Health.

How to Use Cotton Insecticides.

To get best control results of any in-

secticides, special attention must be paid to the time of using. Careless and needless poison treatments often cause farmers to believe that the materials are ineffective when actually the time and method of treatment may be at fault. Dusts should be applied when there is little or no wind to blow it away. Early morning, late afternoon, and night are the best times to apply dusts. Applications should be made directly and close to the row. Since sprays may be applied in winds up to 10 miles per hour, it is often possible to spray during the daytime. Sprays should not be applied too close to the plant or to plants wet with rain or dew. Keep nozzles at least 6 inches from the plant, especially on young plants or when using materials with which you have had no experience. If airplanes are used, be sure that swaths overlap each other. Treatments should be repeated within 2 days if rains occur within 24 hours.

When to Treat.

Early treatment: — Examine fields early to see if weevils or thrips are numerous enough to cause plant injury. Early thrips injury often occurs and is indicated by ragged and cup-shaped leaves. When thrips are numerous young plants may be severely stunted or killed. Treatment should be made in the 2-4 leaf stage using any of the recommended materials. It is generally advisable to make a second insecticide application one week after the first application.

Pre-square weevil treatment is highly recommended when weevils are numerous. This treatment is usually started when the cotton plants are approximately 6 inches high.

Treatments When Squares Form:—In most areas it is advisable to begin poisoning for boll weevils when squaring begins. Two or three insecticide applications should be made at weekly intervals after squares begin to form. This is in addition to any applications made before squaring. The number of additional insecticide applications necessary will depend upon the weevil population. A good rule to follow is that of treating when 10% of the squares show weevil punctures. This can easily be determined by examining 100 squares selected at random while walking diagonally across the field from one corner to another. If 10 or more out of every 100 squares have weevil punctures, treatments should be made. A check of the square infestation should be made each week.

Late Season Treatments:—Adult weevils emerge from infested squares and begin to move around from field to field in great numbers in late July or early August. The food supply becomes smaller as the season advances and the weevils become more numerous. The fewer squares left are more heavily attacked and even the older bolls may also be subject to severe weevil damage. This is the time that is known as the migration period. Frequent poisoning is particularly important at this time when large numbers of weevils or bollworms are present. For weevil control at this time, slightly increase the amount of insecticide per acre and shorten the interval between applications. Apply at 4 or 5 day intervals until most of the bolls are mature enough to resist weevil attack.

Bollworms may become a problem at this time. Much bollworm damage can be prevented by timely inspection of cotton and by poisoning treatments. During August, look for small, brownish worms in squares or in bolls. Begin poisoning for bollworms when 4 or more worms are found on 100 bolls. It is very important to control bollworms when they are small. The larger worms are harder to kill and even though killed have already done considerable damage. Ordinarily, applications for boll weevil control during early August will hold this pest in check. If control is not satisfactory with the weevil applications, increase regular dosage to 15 to 20 pounds per acre or make two applications of a 10% DDT dust at a 5 day interval. If using a spray, step the dosage of DDT up to 1.0 pounds per acre per application.

Principal Cotton Insect Pests in North Carolina

The most serious pests of cotton are boll weevils, bollworms, aphids, thrips and red spider mites. Other pests include cotton fleahoppers, tarnished plant bugs, rapid plant bugs, and leafworms.

Boll weevils are long snouted hard-shelled beetles, ¼ inch long, grayish black or brown. They over-winter as adult weevils in trash around fields, cotton gins, buildings and emerge in late spring and early summer to feed on young cotton before squares are formed, feeding on tender tips of cotton plants. When squares form, weevils feed on these and lay eggs in them. The larva (grub) hatches from the egg inside the square and eats out the square, usually

causing it to drop. Bolls are also attacked. It takes about 20 days from time of egg-hatching to emergence of adult from square. Three or more generations are possible in North Carolina, depending on weather conditions and location within the state.

Bollworms when full grown are light green or brown worms about 1 inch long. They eat holes in squares and in bolls. Boll damage is usually more severe than square damage for bollworms ordinarily appear late in the season, after corn silks begin to dry. Corn is the preferred food plant, but cotton and tomatoes are also attacked. Larger worms feed inside bolls and hence are hard to poison. Worms enter ground to change to pupal stage. They winter over in pupal cells in the ground. Adults are light brown moths.

Cotton aphids usually attack young plants, causing leaves to curl under. Aphids (lice) suck plant juice from leaves, causing them to turn brown and brittle, and the whole plant dies. Cotton aphids also feed on many other plants including squash, cucumbers, and melons. They are soft bodied insects, black, yellow, or dark green in color, about the size of small BB shot. Aphids spend the winter on weeds and spread to cotton early in the season. Reproduction is rapid and continuous. Hence, large populations can build up rapidly.

Cotton thrips are small, green to brown, spindle shaped insects, just about visible to the naked eye. They feed on leaf surface by rasping plant tissue and sucking plant sap and cause leaves to curl up and look ragged, especially on young cotton (aphids cause leaves to curl down). In severe cases, young plants will have no terminal buds. This pest may become more of a problem as winter cover crops are used more widely.

Red spider mites are small, 8-legged, green, yellow or red, scarcely visible to the naked eye. They feed on underside of leaves by sucking out plant juices, causing reddish blotches to appear in leaves, which many growers know as "rust." Numerous species of plants are attacked and feeding on cotton begins early in the summer. Infestations usually are localized when first noted.

Cotton fleahoppers when young are small, pale green, with spindly legs. Adults are about ⅛ inch long, with body pale green with black hairs and black specks on upper surface. They feed by sucking on young squares, causing shedding of squares and tall whip-like growth of plants. Fleahoppers are most active during the squaring season.

Tarnished plant bug adults are about ¼ inch long and one half as broad, flattened and oval in outline. The general body color is brown. They damage cotton by sucking plant juices, especially at tender terminal ends.

Rapid plant bugs are sucking insects of minor importance that feed in a manner similar to that of the tarnished plant bug.

Cotton leafworms are slender greenish colored looping worms, about 1 inch long when full-grown, with black and white stripes and numerous black dots scattered over their bodies. Adults are tan colored moths. These insects do not overwinter here but migrate in from southern regions usually late in the season. Leafworms feed by chewing foliage. They may strip or rag all the leaves on a plant. They form cocoons in folds of leaves. Ordinarily, leafworms appear too late in the season to do any real damage.

Control of Insects in—
• Oklahoma

Cotton insect control recommendations have changed more since the beginning of World War II than they did in twenty or twenty-five years preceding it. Changes were brought about by the introduction of the new organic insecticides such as DDT, benzene hexachloride, toxaphene, aldrin, and mixtures of these. Some of these insecticides will control one cotton insect pest but not another. For instance DDT will control the bollworm but is not effective in controlling the boll weevil or leafworm. Benzene hexachloride will control the boll weevil but not the bollworm. Toxaphene will control both the boll weevil and the bollworm. All organic insecticides often cause a red spider mite infestation to develop unless the dust contains at least 40 percent sulfur.

For cotton insect control Oklahoma can roughly be divided in three zones. In the eastern part of the State, the boll weevil can be expected to occur in damaging numbers in most years, and in the southeastern part of Oklahoma it appears in damaging numbers every year. Two early applications of approved insecticides will control overwintered wee-

vils. The first application should be made one week after the appearance of the first squares on the plants and before any of them are large enough for the boll weevil to puncture. The second application should be made a week later. The purpose of these treatments is to destroy the overwintered weevils which have migrated into the cotton fields from hibernation before they have had an opportunity to lay eggs for the first generation. In some years frequent rains favor the development of bollworms in destructive numbers, especially when there is considerable corn growing near cotton. These rains also cause heavy late boll weevil development. When these conditions occur it is necessary to protect cotton by three or more applications. These later applications should be started one week after the first bloom appears and be spaced at 5-day intervals. They are for the purpose of controlling the bollworms and boll weevils at a critical time in boll production of the plants.

In the western part of the State the boll weevil either does not occur or is not a limiting factor in cotton production in most years. For this section we recommend at least two treatments. These applications should be made to control boll weevils or other cotton insects when they appear in destructive numbers.

Intermediate between these two sections of the State is another area where the weevil does not occur in injurious numbers early in the season but may under certain conditions migrate into the cotton fields in mid-season and cause damage. Since the bollworm is also a problem in this section, we recommend three applications, beginning about July 30 and spaced at 5 to 7-day intervals. If there is some uncertainty about following a regular poisoning program, an infestation count is recommended.

Farmers are urged to order their insecticides early because some materials may be hard to obtain later in the season. Farmers should stock enough insecticides now for two to four applications so manufacturers will be able to meet the demand later in the season. ORDER EARLY AND BE SAFE.

The following dusting materials or combinations of dusting materials have given good cotton insect control in Oklahoma during recent years:

Benzene Hexachloride
(3% gamma isomer)
5% DDT and 40% Sulphur Mixture

For Boll Weevil Control

Apply at the rate of 10 pounds per acre when the square infestation is 10 percent or above, or as previously indicated.

Apply at 5-day intervals when air is calm until weevils are under control.

If washed off in 24 hours repeat application.

For Bollworm Control

Apply at the rate of 10 pounds per acre when the bollworms make their first appearance, and if possible before they have entered the cotton bolls.

For Cotton Aphid, Cotton Fleahopper, Plant Bug and Leafworm Control

When fields are treated with the above mixture for either boll weevil or bollworm control the above insects will also be controlled.

Do not mix this 3-5-40 combination with calcium arsenate, lime or other alkaline materials because the chemical reaction may cause them to be less effective. However, there is a lime-free calcium arsenate that can be mixed with either of the above insecticides.

Benzene Hexachloride

For Boll Weevil Control Only

Use benzene hexachloride containing 5 percent gamma isomer applied at the rate of 10 pounds per acre.

This will control the boll weevil, but often permits the bollworm to build up in damaging numbers and the entire crop of bolls may be destroyed.

DUST WHEN THE AIR IS CALM.

Oklahoma Insect Control Recommendations

DUSTS

INSECT	INSECTICIDE	Lbs. Per Acre	APPLICATION
Boll Weevil *	3% g BHC, 5% DDT, 40% Sulfur	10	Before squares are large enough to be punctured by overwintered weevils; second application 7 days later.
	or 20% Toxaphene, 40% Sulfur	10	Same as above
Boll Weevil **	3% g BHC, 5% DDT, 40% Sulfur	10	When 10% infestation occurs; at 5-7 day intervals as necessary.
	or 20% Toxaphene, 40% Sulfur		Same as above
	or Calcium Arsenate	5-7	As above or alternating with 3-5-40.
Leafworm	3% g BHC, 5% DDT, 40% Sulfur	10	As necessary
	or 20% Toxaphene, 40% Sulfur	10	Same as above
	or Calcium Arsenate	7-10	Same as above
	or Arsenate of Lead	2	Same as above
Bollworm	3% g BHC, 5% DDT, 40% Sulphur	10-15	When 4-5 worms per 100 plants; at 5-day intervals until controlled.
	or 3% g BHC, 10% DDT, 40% Sulfur	10	Same as above
	or 20% Toxaphene, 40% Sulfur	10-15	Same as above
	or 10% DDT	10-15	Same as above
Fleahopper	3% g BHC, 5% DDT, 40% Sulfur	10	When 25 fleahoppers per 100 terminal buds; at 7-10 day intervals. (Control usually achieved with weevil schedule.)
	or 20% Toxaphene, 40% Sulfur	10	Same as above
Aphid	3% g BHC, 5% DDT, 40% Sulfur	10	As necessary
	or 20% Toxaphene, 40% Sulfur	10	Same as above
	or Nicotine Dust	10	Same as above

SPRAYS

Timing of spray applications should be the same as for dusts as given above.	
Boll Weevil *	Toxaphene, 1 lb. actual chemical per acre. or Toxaphene, DDT; 1 lb. Toxaphene, 0.5 lb. DDT actual chemical per acre.
Boll Weevil **	Toxaphene, 2 to 3 lbs. actual chemical per acre. or Toxaphene, DDT; 1.5 to 2 lbs. Toxaphene, 0.75 to 1 lb. DDT actual chemical per acre.
Leafworm	As for boll weevil** above.
Bollworm	DDT, 1 lb. actual chemical per acre. or Toxaphene, DDT; 1.5 to 2 lbs. Toxaphene, 0.75 to 1 lb. DDT actual chemical per acre.
Fleahopper	Toxaphene, 1.5 to 1.75 lbs. actual chemical per acre. or Toxaphene, DDT; 0.5 lb. Toxaphene, 0.25 lb. DDT actual chemicals per acre.

* Pre-square
** After squaring

CAUTION: Benzene hexachloride formulations should not be used where potatoes, peanuts or other root crops will follow cotton the next year for often an objectionable taste is given these crops.

DDT

For Bollworm Control

Use a 10 percent dust and apply at the rate of 10 to 15 pounds per acre.

Apply when worms are small and before they enter the bolls.

DUST WHEN THE AIR IS CALM.

Two or more applications may be required for control.

DDT may cause heavy aphid infestation.

Do not mix DDT with common calcuim arsenate, lime, or other alkaline materials.

Toxaphene

For Boll Weevil Control

Use a 20 percent dust plus 40 percent sulfur and apply at the rate of 10 to 12 pounds per acre.

Apply at 5-day intervals when the square infestation is 10 percent or above.

If washed off in 24 hours repeat application.

DUST WHEN THE AIR IS CALM.

For Bollworm Control

Use a 20 percent dust plus 40 percent sulfur and apply at the rate of 10 pounds per acre.

Apply when the worms first make their appearance and before they enter the bolls.

For Leafworm, Cotton Fleahopper, Aphids, and Plant Bug Control

Use a 20 percent dust plus 40 percent sulfur and apply at the rate of 10 pounds per acre.

One application is usually sufficient.

Calcium Arsenate

For Boll Weevil Control

To be used where the bollworm is not an important pest.

Apply when the square infestation is 10 percent or above and at the rate of 5 to 7 pounds per acre.

Applications should be made at 5-day intervals until the weevils are under control. Usually three or four applications will be sufficient.

If washed off in 24 hours repeat applications.

Calcium arsenate should not be mixed with benzene hexachloride or DDT. However, special lime-free calcium arsenate is manufactured which can be mixed with these insecticides.

Continued use of calcium arsenate will cause a heavy aphid infestation.

Alternate applications of calcium arsenate and the 3-5-40 dust will also give good cotton insect control. This combination can be used in an emergency and when bollworms are not a serious threat. Should bollworms begin to appear, use 3% gamma BHC, 10% DDT, 40% sulfur and stop the applications of calcium arsenate.

For Leafworm Control

Apply at the rate of 7 to 10 pounds per acre. One application is usually sufficient.

The following insecticide dust mixtures have been tested at various times in Oklahoma but have not given as good control as the above:

10% Chlordane, 5% DDT Mixture, or
2.5% Aldrin, 5% DDT Mixture, or
2% Dieldrin, 5% DDT Mixture

Most effective when applied at 3- to 5-day intervals over a large area at 10 pounds per acre early and 15 pounds per acre later.

EXTREME CARE SHOULD BE USED IN HANDLING ALDRIN AND DIELDRIN.

How and When to Dust Cotton

Dust insecticides may be applied at any time of the day or night when the air is calm. Dust can be applied with any type of ground equipment such as hand dusters, cultivator attached dusters, cart dusters on which the power is generated by a small motor, and by power take-off dusters. There is a type of duster to meet the needs of the individual farmer. Most of the ground dusting during the past few years has been done by power take-off dusters which dust from 4 to 8 rows at a time.

If dust is applied by an airplane, the plane must be flown just above the cotton plants and the swaths should not be wider than the wing spread of the plane, which is usually 30 to 40 feet. The farmer should always furnish a spotter for the plane so that the pilot will know just where to make each flight through the field. Do not permit pilots to dump large quantities of dust on a few rows in the field and make wide swaths, for the control will be very disappointing.

How and When to Spray Cotton

Two years of testing by the Oklahoma Experiment Station have shown that boll weevils, bollworms, leafworms, and thrips can be successfully controlled by spraying as well as by dusting. In these tests, emulsifiable concentrates were used

in low gallonage and low pressure sprayers.

Emulsifiable concentrates containing twice as much toxaphene as DDT and toxaphene alone have proven effective. The toxaphene-DDT concentrates should be diluted to apply one to two pounds of toxaphene and half that amount of DDT per acre. When toxaphene is used alone, from one and one-half to three pounds per acre should be applied.

The amount of diluted spray applied per acre will vary with the kind of sprayer used, the type of nozzle, the size of the opening in the nozzle, and the number of nozzles used per row. The pressure and speed of the tractor also govern the amount used per acre.

One nozzle per row is sufficient in small cotton before it starts to set squares. Use two nozzles per row on medium sized cotton up to 18 inches tall. Use three nozzles per row in tall, rank cotton. When using one nozzle, set it 6 to 8 inches above the tops of the plants so that the spray cone will completely envelop the plants. When using two nozzles per row set them so as to direct two cones of spray towards the sides of the plants. When using three nozzles per row on larger plants, have the third nozzle set so as to direct a cone of spray downward to cover the tops of the plants. Widen the angle of the two lateral nozzles so as to obtain as much plant coverage as possible.

Nozzles such as used in spraying orchards are not recommended because they use too much spray.

Some difficulties may be experienced in spraying rank cotton where it laps across the rows and the foliage and limbs come in contact with the spray nozzles.

CAUTION: 2-4-D is very toxic to the cotton plant and no ground sprayer or airplane that has been used in applying 2-4-D should be used in the cotton field.

How to Determine When To Begin Treatment

For Pre-Square Treatment

Examine all plants on 100 linear feet of row.

The row should be selected near the center of the field and plants examined at three points in the row.

These points should be near each end of the field and in the middle.

When one or more weevils are found in this space, pre-square applications should be applied.

For Square Protection

To determine the number of punctured squares, walk diagonally across the center of the field, picking 100 squares as you walk. These squares should be half grown or larger and an equal number should be picked from the top, middle and lower branches of the plants. After picking 100 squares, examine them for weevil injury. Record both egg punctures and feeding punctures as damaged squares. The number of squares damaged will give you the percentage of infestation when 100 squares are examined at each point. When 10 squares out of each 100 are punctured, treatment should begin and continue at 5-day intervals until infestation is reduced below 10 percent.

The Pink Bollworm Situation

Oklahoma, after being free of pink bollworms for two years as a result of quarantine measures, was again found infested in the fall of 1950. Specimens were found in Stephens, Jefferson, Cotton, Caddo, Kiowa, Tillman, Jackson and Harmon counties. The following counties are now under quarantine: Stephens, Jefferson, Cotton, Caddo, Kiowa, Tillman, Jackson, Harmon, Greer, Beckham, Washita and Comanche.

The pink bollworm is as yet not numerous enough to require the use of insecticides, and it has not so far caused any injury to Oklahoma cotton.

Control of Insects in—
• South Carolina

Recommended Dusts

BHC-DDT: A mixture containing 3% gamma BHC plus 5% DDT will control the boll weevil, small bollworms, cotton aphid, thrips, cotton leafworm, cotton fleahoppper and other closely related injurious insects. An average of at least 10 pounds per acre per application of this material is recommended for the control of all cotton insects, except where a build-up of either aphids or bollworms is noted. In such cases, make one or more applications of 15 pounds per acre of the 3-5-0 mixture. In emergency situations where bollworms build up late in the season, the use of a dust mixture containing 2% gamma BHC plus 10% DDT and used at the rate of 15 pounds per acre per application is recommended. One or more dustings at 4-daily intervals with this material may be necessary for control.

Toxaphene: A dust containing 20% toxaphene will control the boll weevil, bollworm, thrips, cotton leafworm and cotton fleahopper and will suppress the cotton aphid when this material is used throughout the season. This dust should be used at the average rate of at least 10 pounds per acre per application. If a bollworm outbreak occurs late in the season, make one or more applications at the rate of 15 pounds of 20% toxaphene per application.

Chlordane-DDT: The 10% chlordane-5% DDT dust mixture is effective against the boll weevil, small bollworms, thrips, cotton leafworm and cotton fleahopper. It will not control heavy aphid populations. This material should be used at the average rate of at least 10 pounds per acre per application, except for bollworm control during late season. Use at the rate of 15 pounds per acre for one or more applications to control this insect in such a case.

Aldrin-DDT: When used at the average rate of at least 10 pounds per acre per application, 2.5% aldrin plus 5% DDT will control the boll weevil, small bollworms, thrips, cotton leafworm and cotton fleahopper. In experiments to date, cotton aphids did not build up following its use. Aldrin is also known as Compound 118.

Sulfur: None of the above-named insecticides will control the red spider mites; therefore, one or more applications of 20 pounds of dusting sulfur per acre should be used in case of a build-up of this pest.

Recommended Sprays

Spray Concentrate Insecticides

Insecticides prepared in liquid form are called spray concentrates. They generally are prepared by dissolving one or more chemicals or "toxicants" in suitable solvents. To this are added other chemicals called "emulsifiers" which will cause the mixture to mix easily with water. When water is added to spray concentrates, most of them will form a white to cream-colored emulsion. After an emulsion has been applied by spraying, the water and certain parts of the emulsion evaporate or dry. This drying process "breaks" the emulsion and deposits on the foliage the toxic chemical and other parts of the mixture. The deposit of insecticide from a spray is very adhesive and not easily removed by rain.

Wettable Powders

The wettable powders are mixtures that contain certain chemicals called "wetting agents." It is impossible to use a regular cotton dust in either low or high gallonage spraying equipment. It is also impossible to use a wettable powder in low gallonage equipment.

The mule-drawn, traction sprayer, commonly used for spraying tobacco, is used in some sections of the state for spraying cotton. The wettable powders are usually used in these. It will deliver about 15 gallons of liquid per acre with one nozzle per row and about 50 gallons per acre with three nozzles per row. If this type of machine is used, it is suggested that a 50-mesh screen strainer be used. Low gallonage nozzles can be bought for use with this sprayer that are suitable for spraying with emulsions.

Suggestion on mixing wettable powders: To one part of water in a 55-gallon drum add desired amount of wettable powder. Add remainder of water necessary to give recommended rate per acre. Stir thoroughly. Transfer this mixture into spray tank. Refill spray tank as needed from this prepared mixture. Always stir thoroughly before transfer.

The following spray formulations apply to both emulsifiable concentrates and wettable powders. Use each at the average rate indicated.

Toxaphene: 2 pounds of technical toxaphene per acre per application.

Toxaphene-DDT: 2 pounds of technical toxaphene plus 0.5 pound of technical DDT per acre per application.

BHC-DDT: 0.3 pound of the technical gamma isomer of BHC plus 0.5 pound of technical DDT per acre per application.

Chlordane-DDT: 1 pound of technical chlordane plus 0.5 pound of technical DDT per acre per application.

Aldrin-DDT: 0.25 pound of technical aldrin (also known as Compound 118) plus 0.5 pound of technical DDT per acre per application.

TEPP: None of the above-named spray formulations will "knock out" a build-up of either red spiders or cotton aphids. It is suggested that tetraethyl pyrophosphate be used at the rate of ½ pint of the 40% concentrate per acre. It can be mixed with any of the recommended sprays. Use with caution as this material is highly toxic to man.

DDT: See paragraph 4 under General, page 12, for use of DDT in bollworm control.

Other Insecticides

1-1-1 Mixture: The 1-1-1 mixture is still used in some sections of the state and has proven effective in boll weevil control. This mixture is composed of 1 pound of calcium arsenate, 1 gallon of molasses and 1 gallon of water. Calcium arsenate is a good boll weevil poison but it is not effective against other cotton in-

sects such as thrips, cotton fleahoppers, aphids and red spiders. Because of this, it is not comparable with the all-around insect control made possible with the use of the newer organic insecticides.

When the 1-1-1 mixture is used for early-season boll weevil control, it should be followed by mid-season or later dustings or sprayings with recommended organic insecticides.

Dieldrin (Compound 497): The use of 1.5% dieldrin plus 5% DDT dust or its equivalent in a spray is not recommended for general use in South Carolina during 1951 and is to be used experimentally only. Dieldrin is highly toxic to mammals and is readily absorbed through the skin. Extreme precautions should be exercised when handling or applying dieldrin.

Heptachlor: This insecticide is not recommended for general use in South Carolina during 1951. It has been used extensively only one year and is still on an experimental basis. When used at the rates of from 1/3 to ½ pound of technical heptachlor per acre per application, it was effective against the boll weevil and some other cotton insects. It was not effective against the boll worm, cotton aphid or red spider mite.

Equipment

Some acceptable type of dusting or spraying equipment is necessary if the recommended insecticides are used.

The use of flagmen to mark areas already covered is necessary when airplanes are used to apply either dusts or sprays. Airplanes should not attempt to cover a swath greater than their wing span.

The use of fenders on wheeled equipment during late-season operations will reduce the number of bruised or crushed bolls. Plans are available for home-constructed fenders.

Equipment in which 2,4-D has been used should not be used to apply insecticides to cotton.

Bug-catching machines are not recommended as a means of controlling cotton insects.

Dusting Equipment

A rotary hand duster will care for five acres of cotton. A two-row, animal-drawn, traction duster will be adequate for from 20 to 30 acres. Larger acreages can be cared for by high clearance, mule-drawn, traction dusters covering from 4 to 6 rows or by tractors or airplanes.

When dusting always use a respirator. Avoid unnecessary skin contact with any insecticide. Become familiar with first-aid measures relative to materials being used.

A heavy dew is not essential for satisfactory dusting conditions but the atmosphere must be calm. Dusting conditions are usually best during the hours from 5:00 p.m. to 9:00 a.m. Do not dust if wind is over 3 miles per hour. Do not depend on drift of dust from one row to another to control insects. If rain occurs within 24 hours after poisoning, repeat application within 48 hours.

Spraying Equipment

A 2- to 6-row low gallonage sprayer, mounted on tractor- or animal-drawn equipment, has been found satisfactory for cotton spraying. On very hilly land it is advisable to use equipment covering only 2 to 4 rows. The mule-drawn, traction-powered tobacco sprayers are being used with good results in South Carolina in the application of wettable powders.

If emulsifiable concentrates are used with the tobacco-type sprayer, protective shields should be mounted on them to prevent the operator from coming in contact with the spray drift.

Sprays should be applied only when the plants are dry. Do not spray cotton that is wet with either dew or rain. Sprays can be effectively applied in winds up to 10 miles per hour. It is recommended that sprays be applied only with mechanical equipment that will prevent the spray drift from coming in contact with the operator.

Spray Pump: For tractor-mounted sprayers, the spray pump should be of the power take-off type, with an efficient delivery of 540 r.p.m. Pumps with a sleeve to slide over the standard power shaft provide an easy and quick means of attachment. By-pass and pressure regulator valves are essential to maintain the desired constant pressure.

For gasoline-powered pumps (auxiliary engine-driven pumps as used on animal-drawn spray rigs) it has been found that a jack-shaft with a flexible coupling between the shaft and the pump will avoid excessive leaking at the pump packing gland. These pumps should have the same capacity and other features as power take-off driven pumps.

Spray Nozzles: A nozzle of the hollow cone type is best suited for spraying cotton. The equipment should be operated at the manufacturer's specified pressure.

Spray Nozzle Operation: Maintain nozzle direction and adjustment to manufacturer's specified distance from foliage. In most cases this is from 8 to 10 inches. Check this distance after each round and see that nozzles are functioning properly at the manufacturer's specified pressure.

Nozzles Per Row: The number of nozzles needed for good coverage will vary with the size of the cotton plant. The spraying of cotton on hilly, terraced rows should begin with two nozzles per row

and be changed to three nozzles per row when the first blooms are seen. In areas where fields are flat and rows are straight, it should be possible to get good coverage with one nozzle per row until the first blooms are seen. At that time a change to two nozzles per row would be necessary, and, for late-season control, the use of three nozzles per row will prove satisfactory.

Strainers: Strainers are an important part of low gallonage spray equipment. The inlet or suction hose should be equipped with a strainer to prevent any foreign material from entering the pump. This should eliminate a large percentage of stoppages at both the pump and nozzles. The pump and nozzles should also be provided with strainer or filters. Regardless of the care exercised to prevent nozzle stoppages, some will occur. Extra nozzles should be provided in order to make a quick change in the field without losing time to clean a plugged one.

Care of Sprayer: Care should be exercised in cleaning the entire machine. It is a good practice to run clear water through the system for several minutes at the end of each day's operation. Nozzle tips are made of soft material and are easily damaged. If hard objects are used for cleaning tips, the orifice will probably be altered in both size and shape. This will result in varying both the spray pattern and rate of application. Nozzles may be cleaned by washing in water or fuel oil or by using compressed air. Never use an object harder than a horse hair for probing into the orifice of the nozzles.

Mixing the Emulsion: The emulsion concentrate should not be diluted with water until spraying is started. Pour out the required amount of spray concentrate into a suitable container. Add to this an equal amount of water. Stir thoroughly until the mixture is creamy white. Pour this mixture into the required amount of water in the spray tank. Start the pump and agitate the finished spray for at least two minutes by pumping back through the overflow into the tank. *CAUTION: Do not add the spray concentrate directly to the tank without predilution.*

The diluted or emulsified insecticide must remain stable; that is, the oil must not separate from the water. If this happens the concentrate should be discarded or exchanged for another brand which will "hold," for a "broken" emulsion is not only ineffective but will seriously damage cotton foliage. Once an emulsion is "broken" it cannot be re-emulsified. If spraying operations are interrupted while there is still spray material in the tank, this material should be thoroughly agitated before resuming operations. This can be done by recirculation with the pump for a few minutes.

Source of Water: The water used for diluting the spray should be perfectly clean. This is necessary because small trash or mud in the water will produce unnecessary wear on the pump and continually cause clogging of the nozzles, resulting in inefficient spraying and loss of time. The best source is from a closed water system. Under no circumstances should muddy water be used. Where creek or pond water must be used, oversize filters are reported commercially available for clarifying such water.

CAUTION: Liquid concentrate insecticide spilled on skin or clothing is extremely dangerous. Immediately remove clothing and bathe thoroughly with plenty of soap and water.

As soon as possible after poisoning operations are concluded, the operator should remove clothes contaminated with the insecticide and should bathe. Spillage of insecticides where they might drain into water used by man or livestock should be avoided. The dumping of any poisons even in small amounts near sources of water supplies should be avoided. If metal or glass containers are to be saved, they should be thoroughly washed and cleaned immediately after emptying.

When to Apply Insecticides

The life history of the boll weevil and fruiting habits of the cotton plant indicate that continuity of poisoning application is essential. Any particular schedule of applications will not be suitable to all situations. Local insect infestations, stage of development of the cotton plant and weather conditions are vital factors in fixing these schedules of poisoning on any farm. Therefore, it is up to the individual farmer to gain a fuller knowledge of his own insect problems. One way to do this is by making weekly field observations to determine what insects are present, and, in the case of boll weevils, what the percentage infestation may be.

A simple and accurate *method of making a boll weevil infestation count* is to walk diagonally across a field, picking 100 squares at random from top, middle and lower branches. The number of punctured squares found gives the percentage infestation by boll weevils in that field. Count both egg laying and feeding punctures as punctured squares. If the field is extra large or if conditions vary greatly within the field, it is desirable to take more than one sample of 100 squares.

A bollworm threat can be detected by weekly examinations of a representative number of terminal buds for eggs and newly hatched larvae. The majority of the eggs and small worms can be found on the stems and leaves of the top 3 or 4 inches of the tender terminal growth. The eggs are creamy white and are about ¼ to ½ the size of the head of an or-

Summary of Cotton Insect Control for South Carolina In 1951—Recommended Poisoning Schedules

Time of Application	DUSTS	Sprays									
	3% BHC—5% DDT 20% Toxaphene 10% Chlordane—5% DDT 2.5% Aldrin—5% DDT	BHC	Aldrin	Tox. or Tox. - DDT	Chlor. - DDT	Tox. or Tox. - DDT	Chlor. - DDT	Tox. or Tox. - DDT	Chlor. - DDT	Tox. or Tox. - DDT	Chlor. - DDT
		Pounds of Toxicant per Gallon of Concentrate*									
		0.8**	2.0	4.0		5.0		6.0		8.0	
	Lbs. per Acre	Pints of Concentrate per Acre									
Pre Square Control for: (Usually needed in the Piedmont)											
Thrips—when injury is first noticed	6-8	2.10	0.70	2.80	1.40	2.40	1.20	1.90	0.95	1.40	0.70
Boll Weevils—when buds are attacked	6-8	2.10	0.70	2.80	1.40	2.40	1.20	1.90	0.95	1.40	0.70
7 days after 1st application	6-8	2.10	0.70	2.80	1.40	2.40	1.20	1.90	0.95	1.40	0.70
Pre-Bloom or Early-Season Control:											
When first squares are seen	8-10	2.70	0.90	3.60	1.80	3.00	1.50	2.40	1.20	1.80	0.90
7 days after 1st application	8-10	2.70	0.90	3.60	1.80	3.00	1.50	2.40	1.20	1.80	0.90
7 days after 2nd application	8-10	2.70	0.90	3.60	1.80	3.00	1.50	2.40	1.20	1.80	0.90
Blooming Period or Mid-Season Control:											
When first blooms are seen	10-12	3.30	1.10	4.40	2.20	3.60	1.80	3.00	1.50	2.20	1.10
7 days after 1st application	10-12	3.30	1.10	4.40	2.20	3.60	1.80	3.00	1.50	2.20	1.10
7 days after 2nd application	10-12	3.30	1.10	4.40	2.20	3.60	1.80	3.00	1.50	2.20	1.10
Maturing Period or Late-Season Control:											
When 10% of squares are punctured or migration begins (whichever occurs first)	12-15	4.05	1.35	5.40	2.70	4.50	2.25	3.60	1.80	2.70	1.35
4 days after 1st application	12-15	4.05	1.35	5.40	2.70	4.50	2.25	3.60	1.80	2.70	1.35
4 days after 2nd application	12 15	4.05	1.35	5.40	2.70	4.50	2.25	3.60	1.80	2.70	1.35

*There are several formulations of spray concentrates available. On each container there will be stated the total amount of toxicant, that is, BHC, Toxaphene, etc., that is to be found therein. This is usually stated in pounds of active ingredients per gallon. The above table gives the amounts, in pints of concentrate, to be used per acre per application.

**Gamma isomer.

dinary straight pin. See paragraph 4 under GENERAL for control measures.

The first evidence of thrips injury on seedling cotton is a "silvering" on the underside of the leaves. Later stages of the injury can be recognized by the puckering of the leaves. This is sometimes referred to as "possum-eared" cotton.

Pre-Square Control: If thrips or boll weevils are damaging seedling cotton, make two or more applications of a recommended organic insecticide at weekly intervals, beginning: for thrips control, when injury is first noticed; for boll weevil control, when buds of plants are attacked. This may prove profitable by allowing the plants to grow more rapidly and thereby produce an earlier crop.

Pre-Bloom or Early-Season Control: In areas where boll weevils cause damage every year, three or more early-season applications of poison, starting as soon as the first squares are seen, are recommended. These applications should be spaced one week apart. They will destroy many of the over-wintering weevils, protect the early set of bolls and delay the normal weevil build-up.

Blooming Period or Mid-Season Control: When first blooms are seen, make three applications at weekly intervals. This additional series of applications should protect your cotton until migration. However, if following the last application the percentage infestation averages 10 percent or more, additional applications will be profitable.

Maturing Period or Late-Season Control: The protection of young bolls (those less than three weeks old) is often necessary at this time when climatic conditions during mid-season are favorable for rapid boll weevil development. When the boll weevils become numerous in any field late in the season and the plant is in a vigorous growing condition, three or more applications should be made at 4-day intervals. This series of applications will also control the bollworm if applied when bollworm eggs and small worms are first observed on the plant terminals.

NOTE: If rain occurs within 24 hours after any dusting, repeat within 48 hours.

General

1. For complete seasonal cotton insect control, follow either the dusting or spraying schedule which includes nine or more applications.

2. Always use a respirator when dusting. Avoid unnecessary skin contact with any insecticide.

3. Whenever BHC, aldrin or chlordane is used, it is recommended that an average rate of 0.5 lb. technical DDT per acre be included for bollworm control.

4. There is a possibility that bollworms may build up during mid-season and later. If bollworm eggs and small worms appear, use 15 pounds of any of the recommended poisons per acre, or for spraying, add 1.0 lb. of technical DDT per acre. In emergency situations where bollworms become numerous late in the season, it is recommended that one or more applications of a dust containing 2% gamma BHC plus 10% DDT be used at the rate of 15 pounds per acre, or for spraying, add 1.5 lbs. of technical DDT per acre.

5. Where dusts other than BHC-DDT are used and a heavy infestation of aphids occurs, make one or more applications of 15 pounds per acre per application of the 3% BHC-5% DDT mixture.

6. None of the recommended dust insecticides will control the red spider mides; therefore, one or more applications of 20 pounds per acre of dusting sulfur should be used in case of a build-up of these pests.

7. Where sprays are being used and an outbreak of either aphids or red spider mites occurs, use 0.5 pint of 40% TEPP per acre. It can be used in mixture with any of the recommended spray formulations. Use with caution as this material is highly toxic to man.

8. To determine actual gallons per acre used, fill tank of spray rig with a measured amount of water, say 50 gallons. Measure with a bayonet gauge and mark. Start pump and set regulator at specified pressure. Spray a measured acre at your normal operating speed. Note time required to cover an acre. Stop rig and measure amount of water needed to refill spray tank to original level. This will give you the amount of finished spray your rig will use per acre.

9. To mix spray, pour out desired amount of concentrate into a suitable container. Add an equal amount of clean water. Mix thoroughly. Pour this prediluted solution into spray tank and add water until level is attained. Start pump and agitate finished spray for at least two minutes by pumping back through overflow into tank. *CAUTION:* Do not add concentrate directly to spray tank without predilution.

10. Regardless of the number of gallons of water required to cover an acre

(as determined by testing your spray rig), use the amount of concentrate per acre as suggested in SUMMARY.

11. The uniformity of application of any insecticide is largely dependent upon a constant rate of travel. A convenient rate of speed should be selected and then maintained. In spraying, slight variations in pump pressure can determine the desired flow of spray.

Control of Insects in—

• Tennessee

General Supply and Outlook

Damage from cotton insects on many farms in Tennessee ranged from partial to complete destruction of the cotton crop in 1950. However, many farmers showed by practice that it was possible and profitable, despite the heaviest infestation of cotton insects within the past 27 years, to keep cotton insects under control with good use of insecticides. Use of control measures in 1951 will be an important factor in production of a maximum crop in 1951.

Some insecticides are likely to be in short supply in 1951 because of diversion of materials to other uses. Chlorine, benzene, and sulfur, for example, will be limited.

Because of anticipated shortages, farmers should be urged to get enough insecticides as quickly as possible for 3 or 4 applications.

It is impossible now to forecast how much insecticides will be needed; but farmers will be in better position to estimate needs after early-season treatments. Results of experimental work and experience of farmers in 1950 showed good profits from poisons applied in relation to needs. In some cases 8 to 15 applications necessitated by continuous rainy weather still showed good profits.

Insecticides will not deteriorate if properly stored. Dusts should be kept dry. Liquids also should be protected, and should be stirred thoroughly before using.

Cotton aphids and the red spider pose special problems. If calcium arsenate is used, an aphicide must be added in at least every other application, or alternate with 3-5-40. Two percent nicotine can be used in alternate applications, or 1 percent nicotine in every application. Another substitute would be 1 percent rotenone in every application with calcium arsenate, although only preliminary tests support use of rotenone.

Parathion is very effective against aphids and red spiders, but because of its high toxicity and resultant hazards to humans, its use is not recommended. Furthermore, parathion must be used with a special type (low lime) calcium arsenate which is high-priced and difficult to obtain.

For aphid and red spider control, sprays with TEPP are satisfactory. This material also is hazardous and should be used with caution. In fact, all insecticides should be used according to recommendations for safety. READ ALL LABELS.

Short supplies of sulfur will make it difficult to obtain 40 percent sulfur for all dusts for red spider control. A new material under the commercial name of Aramite gives good control of red spider when used at the rate of .3 pounds per acre, either as dust or spray.

New Materials and Boll Weevil Expectations

Only the newer insecticides are effective against early-season cotton insects; and several choices are open among these new materials. Calcium arsenate is effective only for control of boll weevil and bollworm.

WHAT ABOUT THE BOLL WEEVIL IN 1951?

This question will be asked frequently. The only answer now is that nobody knows what the boll weevil situation will be in 1951. The boll weevil went into hibernation last fall in all cotton growing areas in Tennessee. It is not known just what temperatures will kill all hibernating boll weevils. However, the colder the weather this winter, the greater will be the kill of hibernating boll weevils. It is too much to expect that cold weather will kill all the weevils; but it is not anticipated that weevils will injure seedling cotton generally as they did in 1950.

TWO OR THREE WEEKS OF HOT, DRY WEATHER WHEN THE COTTON IS FRUITING HEAVILY WILL GREATLY REDUCE BOLL WEEVIL INFESTATION.

It is practically a certainty that one or more of the early season insect pests will infest cotton fields, such as thrips, flea beetles, and cutworms. Keeping these early pests under control will get the plants off to a good start, and bring about an earlier harvest. Thus early season control is very important. The new insecticides can be used either as spray or dust.

Insecticide Equipment

Application of insecticides is equally effective by ground equipment or by airplane, "if properly done." One of the most important developments in cotton insect control equipment is the "low pressure-low volume" sprayer. There has been practically no improvement in dusting equipment. The sprayers are generally available, and can be used in chemical control of weeds, EXCEPT THAT THEY SHOULD NOT BE USED WITH 2,4-D.

Sprayers mounted on horse-drawn carts have a distinct advantage over sprayers mounted on tractors. It is extremely important that a definite control schedule be maintained; and the light carts can be used in wet weather when it would be impossible to use a tractor.

In airplane dusting or spraying, the plane should fly about five feet above the cotton, covering a swath no wider than the wing spread. For spraying by plane, one to two gallons of material is suggested; for dusting, 10 to 15 pounds.

Late afternoon or the evening is the best time for applying dusts. Dust should NOT be applied during windy periods.

Sprays, cheaper and more satisfactory for early-season control, can be applied over a wider range of weather conditions, even with fairly strong winds. They should be applied when plants are dry, however, to prevent dilution.

All of the materials recommended for cotton insect control are poisonous to man. They should be handled carefully; operators should be certain not to breathe fumes from insecticides; and a bath and change of clothes should follow operations wherein the clothes might have become contaminated with dusts or sprays.

READ ALL LABELS.

Machines for catching cotton insect pests are not recommended. They are not effective.

Insects and Control Measures

1. Thrips and fleabeetles. Poisoning for these pests will be generally needed throughout the state. The first application is recommended when the two seed leaves (cotyledons) unfold. One or two additional applications at weekly intervals are recommended. These treatments prevent ragging and destruction of stands. Early applications get the cotton off to a good start and result in earlier harvest. Early pickings usually are the highest grades of cotton.

2. Hibernating Boll Weevils, Fleahoppers, and Plant Bugs. The next applications should begin when the plant has seven to nine leaves. These treatments protect the first squares which are not actually visible. Treatments are applied to set and hold the crop. Three or four applications should be made at weekly intervals, at the beginning of bloom development.

3. Summer and Late Season Control. After the early treatments further poisoning should be based on weekly infestation counts. This is the best way to determine weevil infestations: pick 100 squares as you walk diagonally across a field from two directions, picking equally from top, middle and lower limbs. The number of punctured squares out of each 100 picked is the percent infestation. *Squares should be picked at random from the plants only and not from the ground—no effort should be made to get punctured or non-punctured squares only.* In very large fields two or three such counts should be made.

Summer applications should be made at four or five day intervals, beginning when 10 to 15% of the squares are punctured and continuing, if necessary, until bolls set are mature. During weevil migration (around August 15) it may be necessary to reduce the time between applications to four days and increase the amount of insecticide. *Poisons must be applied regularly in sequential series to get results. Not less than 3 applications should be made during this time.*

4. Bollworms. These pests usually do not cause trouble until late July or early August but were much earlier in 1950. Poisoning should start immediately when 10% of the terminal buds are damaged, using at least one-half pound DDT per acre alone or in combination with all boll weevil poisons except with toxaphene in which case only one-fourth pound is needed.

5. Aphids or Lice. If aphids or plant lice develop following the use of DDT, calcium arsenate or other insecticides, control measures may be required. Benzene hexachloride, tetraethyl pyrophosphate and nicotine are recommended.

6. Red Spiders. Red spiders may sometimes cause injury, especially in areas of insufficient rainfall. Dusting with 20 to 25 pounds sulfur per acre will control some species. TEPP added to sprays at the rate of .1 to .2 pounds per acre also will give good control. Aramite may also be used at the rate of .3 pounds per acre.

7. Cutworms and Grasshoppers. When these insects attack cotton, use toxaphene or dieldrin as recommended for thrips.

Dust Insecticides

1. 3% Gamma Benzene Hexachloride-5% DDT with or without Sulphur (3-5-40 or 3-5-0). This mixture will control practically all cotton insects when used at 10 pounds per acre. If bollworms become numerous, the rate may be increased to 15 pounds per acre if the boll

weevil is also a problem, otherwise 10 to 12 pounds per acre of 10% DDT will control the bollworms. The 3-5 mixture is used most economically when alternated at 4 to 5-day intervals with calcium arsenate at 7 to 10 pounds per acre. If washed off in less than 10 hours, repeat immediately; from 10 to 24 hours repeat the third day.

2. Aldrin. A dust containing 2.5% aldrin at 10 pounds per acre will control the boll weevil, the cotton fleahopper, tarnished plant bug, rapid plant bug, fleabeetle and thrips. Thrips and fleahoppers may be controlled with as little as 5 to 8 pounds per acre. Generally aphids do not build up following its use. Hatching leafworms are killed by it but it does not control large leafworms. Bollworms may be controlled by a mixture of 2½% aldrin and 5% DDT. Aldrin is compatible with all of the new organic insecticides recommended for cotton insect control. If washed off in less than 10 hours repeat immediately; from 10 to 24 hours repeat the third day.

3. Toxaphene. A dust containing 20% toxaphene at 10 to 15 pounds per acre will control the boll weevil, fleahopper, thrips, fleabeetles, grassworm, leafworm, cutworm, grasshoppers and rapid and tarnished plant bugs. Toxaphene at 10 pounds per acre is fairly effective against moderate infestations of the bollworm, but in heavy infestations increasing the dosage to 15 to 20 pounds per acre or the addition of 2½% DDT is desirable. Thrips and fleahoppers may be controlled with as little as 5 to 8 pounds 20% toxaphene per acre. The cotton aphid will not develop injurious infestations if toxaphene is used throughout the season. Toxaphene will not control heavy aphid infestations and should not be alternated with calcium arsenate because of the danger of aphid increase. If washed off in 24 hours it should be repeated.

4. Dieldrin. A dust containing 1½% dieldrin at 10 pounds per acre will control thrips, cutworms, the boll weevil, the cotton fleahopper, tarnished plant bug and rapid plant bug. Thrips, fleabeetles, and fleahoppers may be controlled with as little as 5 to 8 pounds per acre. Aphids do not usually build up following its use. Bollworms may be controlled by a mixture of 1½% dieldrin and 5% DDT. Dieldrin is compatible with the other organic insecticides recommended for cotton insect control. If washed off in 24 hours it should be repeated.

5. Calcium Arsenate. This material is an economical and effective dust for use against the boll weevil, leafworm, and somewhat for bollworm. It is a stomach poison only. It is used at the rate of 10 to 15 pounds per acre for boll weevil and leafworm, and 12 to 16 pounds for bollworms if infestations aren't too heavy.

Dust at 4 to 5 day intervals for boll weevil. Calcium arsenate is used undiluted; and when used without an aphicide, aphids often increase. To control aphids, alternate calcium arsenate applications should contain an aphicide, such as nicotine. (See aphid control directions.)

Liquid Insecticides Suggested for 1951

The new insecticides can be used equally well as sprays or dusts. In general, the recommendations are based upon the amount of chemical contained; the same amount should be used, whether spray or dust. Emulsifiable concentrates of toxaphene, aldrin, dieldrin, benzene hexachloride and DDT, as well as combina-

Tennessee's Cotton Insect Control Schedule

Insect	Begin Treatment	Dusts and Lbs. Per Acre	*Sprays and Nozzles Per Row	Repeat
		Early Season Control		
Thrips, flea-beetle	When stand is up or 2 seed leaves spread.	20% Toxaphene, 2½% aldrin, 1.5% dieldrin, 5% DDT or 3-5-40 (BHC, DDT & Sulfur) 5-8 lbs.	Toxaphene, dieldrin, aldrin, DDT, or GBHC 1 Nozzle	7 days (2 or 3 applications)
Boll Weevil, Fleahopper, Tarnished and Rapid Plant Bug	At first squaring if insects present.	20% Toxaphene, 3-5-0 (BHC & DDT), 2½% aldrin, 1½% dieldrin, 5-8 lbs.	Aldrin, dieldrin, GBHC, or toxaphene, 1 or 2 nozzles, depending on cotton size.	3 or 4 applications at weekly intervals.
		Late Season Control		
Boll Weevil	10-15% Infestation	Same as above 10-15 lbs. or Calcium arsenate 10 lbs.	Dieldrin, aldrin, GBHC or toxaphene, 1 or 2 nozzles,	4-5 day intervals
Bollworm	When 10% of terminal buds are damaged	10% DDT, 3-5-0 (BHC & DDT) 2½-5-0 (aldrin & DDT) 1½-5-0 (dieldrin & DDT), or 20% Toxaphene	Add DDT to above at rate of .25 to 1.5 lb. per acre 3 Nozzles	4-5 days or as needed.
Leafworm	When worms appear	20% Tox., 3-5-0, or Cal. Ars. 10-15 lbs.	Toxaphene, or GBHC 3 Nozzles	As needed
Aphid	At first honeydew	3-5-0, or Cal. Ars. plus 2% nicotine	GBHC or TEPP 3 Nozzles	As needed
Tarnished and Rapid plant bug	When damage first appears	Same as for boll weevil except calcium arsenate	Same as for boll weevil	As needed
Fleahopper	10 to 35 per 100 terminals	Same as for boll weevil except calcium arsenate	Same as for boll weevil	As needed
Red Spiders	When numbers present	Sulfur 20-30 lbs., or aramite .3 lbs.	TEPP 3 Nozzles .1 to .3 lbs., or .3 lbs. aramite	5-7 days

*See text for rates per acre

tions of these, will be available in 1951. The amount of insecticide will vary from 1½ to 8 pounds of toxicant per gallon; therefore, the grower should know the actual pounds present to determine the quantity to use per acre. The amount of spray per acre will vary with the type, make and speed of equipment.

With tractor-mounted equipment, 1 to 5 gallons per acre will usually give good control. For seedling cotton one nozzle per row with ground equipment is recommended, with 2 nozzles on cotton 6 to 18 inches high, and 3 nozzles on plants over 18 inches. Nozzles should be kept 6 to 8 inches from plants to avoid leafburn.

For safety, the spray boom on ground equipment should be fixed behind the operator. It is best to use small hollow cone nozzles with application delivery of at least 30 pounds pressure. The angle of spray from the nozzle should exceed 70 degrees. Tractor speeds should vary from 3 to 5 miles per hour, depending on the size of the cotton. Fender guards should be used on all tractors in late-season spraying. Wettable powders can not be used in low-gallonage, gear-pump sprayers as nozzles will clog and pumps will wear out in a very short time. Spray concentrates can be applied with water at rates of up to 10 gallons per nozzle per acre without dimunition of killing power, so long as the required poundage of actual insecticide is applied.

1. Toxaphene. This should be used at rates varying from 0.80 pound per acre for thrips and cutworms on cotton just out of the ground to 2½ pounds technical material per acre for weevils in July and August. For bollworms add ¼ pound technical DDT per acre. Four, six and eight pounds per gallon concentrates are available.

2. Aldrin (118). For thrips on cotton just up, only 0.08 pound per acre is required but this should be increased to ¼ pound per acre by July for boll weevil and other pests. For bollworms add ½ pound technical DDT per acre. Concentrates containing 2 pounds per gallon are suggested.

3. Dieldrin (497). Dieldrin should be used at rates of 0.05 lb. per acre for thrips; 0.10 pound for cutworms and early weevil control; and 0.15 to 0.20 pound per acre for regular summer boll weevil control in July and August. For bollworms add ½ pound technical DDT per acre when needed.

4. Gamma benzene hexachloride (GBHC). Use this material at rates varying from 0.10 pound per acre with a single nozzle at 30 pounds pressure for thrips and cutworms on seedling cotton to 0.40 pound per acre with 3 nozzles at 40 pounds pressure in July for weevil control. For bollworms add ½ pound technical DDT per acre. Concentrates containing 1.6 pound per gallon are suggested.

5. Tetraethyl pyrophosphate (TEPP). This is suggested for lice and red spiders

at the rate of 0.10 to 0.20 pound per acre in ground machines. A concentrate containing 4 pounds of the technical material per gallon is suggested. Because of the extreme toxicity of concentrates of this material, it's use is recommended as a last resort when other materials are not available.

6. DDT. When bollworm control becomes necessary, emulsions containing DDT should be added to sprays for boll weevil control or used alone at a rate of one-half pound technical DDT per acre except with toxaphene where only one-fourth pound DDT per acre is needed.

Control of Insects in—

• Texas

Insects are a major threat to economical cotton production, but they can be profitably controlled if growers will use the right poisons at the right time. It is important to remember that *poisons must cover the plants to kill insects.* When they put on new growth, or the poison is washed off, plants are no longer protected.

On fertile soils where damaging infestations of boll weevils and bollworms occur, big profits have been made by controlling these pests. This has been true *even when a large number of poison applications was necessary for maximum yields.* On upland soils where insect infestations do not last long, fewer applications may be needed. But they must be made in time to prevent loss of plant vigor, squares, or bolls due to insect damage.

The recommended control program for 1951 is divided into three important phases:

1. *Early Season Control*
2. *Late Season Control, based on infestation*
3. *Early Stalk Destruction and Farm Cleanup*

Each individual grower must carry out the *complete* program if he expects to obtain the greatest benefits. He should make full use of all control measures that will help him get the highest possible acre yields, at the most profit.

Early Season Control

Early season control insures early fruiting and earlier maturity in all areas of the State where thrips, aphids, fleahoppers or boll weevils, alone or in combination, cause damage every year. *Generally, two to four applications made at approximately 7-day intervals give effective control.*

Thrips, aphids, fleahoppers and boll weevils cause more damage in some areas of the State than in others. In these areas of greater damage, three or four applications may be needed. The first should usually be made when the cotton is in the 4-leaf stage. In some cases, however, it may be necessary to treat earlier to prevent loss of stand by thrips, aphids, cutworms or armyworms.

Overwintered boll weevils begin to lay eggs when the oldest squares are about 1/3 grown. On reasonably early planted cotton, the last early season application of poison should be made when plants reach this stage of development. The maximum dosage for insecticides recommended in the Table for early season

control should be used. This will reduce the first generation of weevils.

Regardless of the number of applications in the early season program, *the last should be made at least 30 days before the bollworm usually appears*, unless fleahopper or boll weevil infestations are extremely heavy. This period is desirable to allow time for beneficial insects to build up in sufficient numbers to give some protection against bollworms. Individual fields or farms may receive considerable benefits from early season control but *it is most effective when practiced on a community- or county-wide basis. The larger the area treated the greater the benefits.*

Under some conditions early season applications may afford adequate protection for the entire season. However, in case of severe infestation, additional applications may be needed. In any case, *the use of early season applications is a valuable supplement to complete seasonal control.*

Sprays have given more effective and more economical control of insects attacking young cotton than dusts. Because of the small size of the plants, a greater concentration of the insecticides is obtained from a spray. Frequently, effective spraying can be accomplished at times during the day when dusting is ineffective.

Late Season Control

Late season control depends on the severity of infestation. *Insecticides should be applied when needed no matter whether early season control was followed or not.* The number of applications needed for control varies according to the insect infestation and amount of injury. Moisture and growing condition of plants should be taken into consideration. In other words, there is no point in applying insecticides if cotton is not growing or able to put on fruit, except for late applications for boll protection.

Responsibility for controlling insects rests squarely on the grower's shoulders. Under GENERAL will be found information on how to make insect counts. *Each grower should be able to identify insects, make his own counts and evaluate the damage in order to properly control insects.* The effectiveness of an insect control program depends upon the proper use of recommended poisons. *They must be properly applied at the right time.*

For late season control to be successful, treatment should begin when recommended and continue at 5-day intervals (except as recommended for lygus and stink bugs) as long as infestations make it necessary. The dosage should be increased with the size of the plant and severity of the infestation. All effective combinations of insecticides, and not necessarily preferred insecticides, have been recommended due to an expected shortage in 1951. SEE TABLE FOR SPECIFIC CONTROL RECOMMENDATIONS.

Early Stalk Destruction And Farm Cleanup

Plowing under cotton stalks immediately after harvest, and as far as possible in advance of the first frost, will reduce the boll weevil population. Early stalk destruction forces the boll weevil into a starvation period before time to enter winter quarters. *This prevents a late season build-up of weevils and reduces the number that survive the winter.* Complete stalk destruction to pre-

vent new growth and the elimination of volunteer plants are essential.

Plans must be made in advance, and these plans put into action, to insure an early harvest. Early planting of fast-maturing varieties and early season insect control will make it possible for many farmers to complete harvest before frost. *Early harvest means better grades of lint and higher quality seed.*

Pastures, roadsides, ditch banks, fence rows and other overwintering quarters should be kept free of weeds and debris that harbor insects. Clean up such places by mowing, discing, or with a stalk cutter so as not to create an erosion problem.

Early destruction of stalks by individual growers is worthwhile, *but community-wide or county-wide destruction is still better.* In the southern part of the pink bollworm regulated area, an organization is already set up to get this important job done. In other counties where the crop can be harvested before frost, *an organized effort should be made to secure cooperation on a community- and county-wide basis.*

In the northwestern part of the State where this cannot be done it is recommended that stalks be left standing until after a hard freeze, for pink bollworm control; then they should be plowed under as deep as possible.

Pink Bollworm

The pink bollworm is such a serious threat to economical cotton production that its control is governed by State regulations. The State Department of Agriculture is charged with this responsibility. The Division of Pink Bollworm Control, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, is cooperating with the State Department of Agriculture in its efforts to bring the pink bollworm under control.

Cultural practices including regulated dates for planting and destruction of stalks are specified by the State Department of Agriculture. They remain the most effective means of combating the pink bollworm. Dust containing 2% gamma BHC-10% DDT-40% sulfur at 15 pounds per acre is a supplemental method of control for this insect. Sprays containing 2 to 3 pounds DDT per acre are also effective. *The Extension Service urges support of the pink bollworm regulations.*

General

Recommendations for late season control are based on infestation records. *The grower must learn to make accurate counts at the proper time if he is to use poison most profitably.*

Fleahopper

1. Make weekly examinations. Begin them when cotton is big enough and old enough to produce squares.

2. Examine the main-stem terminal "bud" of 100 cotton plants (about 3 or 4 inches of the top of the cotton plant). Count the number of adults and nymphs. These examinations should be made at several representative points in the field.

Boll Weevil

1. Make weekly examinations for boll weevil. Begin after the plants are squaring freely or have produced as many as 3 squares per plant, at least 1/3 grown. Walk diagonally across the center of the field, picking 100 squares as you walk. Squares should be about 1/3 grown or larger. An equal number should be picked from the top, middle and lower branches of the plants. When 100 squares have been picked, examine them for wee-

vil punctures to determine the percent infested.

2. Two or 3 applications of poison at 5-day intervals are necessary. Poison will effectively control only the adults; therefore, more than 1 application is needed to kill the adults as they develop from the punctured squares. Frequently, more than 3 applications are necessary when infestations are heavy and growing conditions are good.

3. When weevils are found in injurious numbers late in the season after the crop is set, one or more applications of poison should be made to protect the bolls.

Bollworm

1. When most of the corn silks begin to dry, or at the time bollworms usually appear, start examinations for bollworm eggs on cotton. Continue every 5 days until the crop has matured. In general, these dates will be as follows, but check with your County 7-Step Cotton Committee:

Lower Rio Grande Valley and Coastal Bend Area—Second and third weeks in June
South—First Week in July
Central—Second Week in July
North—Third Week in July

2. Examine 100 plant terminals as indicated for fleahopper.

3. If bollworm eggs are found on the terminals and 4 or 5 young worms are found in small squares or on tender top leaves, infestation is high enough to start treatment. When they are first deposited on the plants, bollworm eggs are white and about the size of mustard seed. As hatching time nears, they change to a dirty white color. These eggs will usually be found scattered on the terminal portions of the plant.

4. To obtain effective control, no time should be lost in applying poisons after eggs and 4 or 5 young worms are found. Apply poison at 5-day intervals as long as necessary.

* * *

Booklets showing cotton pests, with their life history, are available from County Agents for free distribution to growers.

Experiments show that dusts and sprays are equally effective in most areas when properly applied. To be effective, repeat applications must be made if the poison is washed off within 24 hours.

Dust applications should be made when the air is calm or nearly so. The presence of dew is not necessary. When ground machines are used, the dust nozzles should be placed 4 to 6 inches over the tops of plants.

Spray applications may be made at any time when winds do not exceed 15 to 20 miles per hour. Spray when plants are dry so the material will stay on the leaves. Poison runs off when leaves are wet. For early season treatment with ground equipment, 1 or 2 nozzles per row, placed 6 to 9 inches over the tops of plants, is sufficient. As plants increase in size, number of nozzles should be increased until a maximum of 3 is in use. Sprays should be applied at approximately 60 pounds pressure and at a volume of 2 to 8 gallons per acre. As a safety measure, it is recommended that spray booms be mounted on rear of the tractor.

Both ground machines and airplanes are effective for applying poison. For best results with planes, it is essential to flag the swaths so they will meet or overlap. Increase dosage recommended in Table at least 50% when an airplane is used for making early season applications.

Under high temperatures some organic insecticides have less residual effect and higher dosages may be required or they may be ineffective. Because of climatic differences in the Lower Rio Grande Valley a SUPPLEMENTAL GUIDE is available for this area.

Some cotton poisons are very destructive to honey bees, and since they are important for pollination of many agricultural crops a determined effort should be made to prevent their destruction.

CAUTION: All insecticides are poisons and precautions given on the labels should be strictly followed. Special precautions should be taken in handling TEPP and Parathion to avoid prolonged contact with the skin or breathing the vapors or drift from either spray or dust.

Texas Recommendations for Insect Control

Early Season Control

Insects	Begin Treatment	DUST PROGRAM	SPRAY PROGRAM
Cutworms and Armyworms.	When needed.	5% DDT, or 10% toxaphene, or 5% chlordane, 20 lbs per acre.	Toxaphene, or 2-1 mixture[1], or DDT, 1 to 2 lbs. per acre.
Boll Weevil[2], Thrips and Fleahopper.	4-leaf stage or earlier if necessary.	20% toxaphene-40% sulfur or 3-5-40 mixture[3], or 2½% aldrin-40% sulfur, or 2½% dieldrin-40% sulfur, 7 to 10 lbs. per acre, 7-day intervals.	Toxaphene, ¾ to 1½ lbs.; or aldrin, ⅛ to ¼ lb.; or dieldrin 1/10 to 1/5 lb. per acre, 7-day intervals.
Aphid.	When needed.	3-5-40 mixture[3], or 1% parathion applied when air is calm.	40% TEPP[6], ½ pint; or 3-5 mixture[4], 1.1. lbs. per acre.

Late Season Control

Boll Weevil.	25 to 35% infestation.	20% toxaphene-40% sulfur, or 3-5-40 mixture[3], or calcium arsenate, or lime-free calcium arsenate plus 1% parathion, or 2½% aldrin-5% DDT-40% sulfur, or 2½% dieldrin-5% DDT-40% sulfur, 10 to 15 lbs. per acre, 5-day intervals.	2-1 mixture[1], or toxaphene, 2 to 3 lbs.; or aldrin-DDT (1-2), or dieldrin-DDT (1-2), ¾ to 1½ lbs. per acre, 5-day intervals.
Fleahopper.	15 to 35 per 100 terminals.	5% DDT-75% sulfur, or 10% toxaphene 40% sulfur at 10 lbs., or sulfur 12 to 15 lbs. per acre, 7-10 day intervals.	Toxaphene, or DDT, or 2-1 mixture[1], ¾ lb. per acre, 7-10 day intervals.
Bollworm.	When eggs and 4 or 5 worms are found per 100 terminals.	Same as for boll weevil, 2-10-40 mixture[5] 15 to 20 lbs. per acre preferred for heavy infestations.	Same as for boll weevil.
Leafworm.	When worms first appear.	Same as recommended for boll weevil when needed, except omit aldrin-DDT and dieldrin-DDT.	Toxaphene, or 2-1 mixture[1], 1 to 2 lbs. per acre as needed.
Aphid.	When honey-dew first appears.	3-5-40 mixture[3], or 1% parathion, 10 to 15 lbs. per acre for "knockout."	40% TEPP[6], ½ pint; or 3-5 mixture[4], 1.1 lbs. per acre for "knockout."
Red Spider.	When leaves begin to turn yellow or rusty brown.	Sulfur, 20 to 25 lbs.; or 1% parathion, 10 to 15 lbs. per acre as needed.	40% TEPP[6], ½ pint; or aramite[7], 1/3 lb. per acre as needed.
Lygus and Rapid Plant Bug.	When damaging infestation appears.	Same as fleahopper except omit sulfur.	Same as for fleahopper.
Stink Bugs.	When damaging infestation appears.	20% toxaphene-40% sulfur, or 3-5-40 mixture[3], or 2-10-40 mixture[5], 10 to 15 lbs. per acre, 7-day intervals.	Toxaphene, or DDT, or 2-1 mixture[1], 2 to 3 lbs. per acre, 7-day intervals.
Grasshoppers.	When damaging infestation appears.	20% toxaphene-40% sulfur, or 3-5-40 mixture[3], or 10% chlordane-sulfur, 15 to 20 lbs.; or 2½% aldrin-40% sulfur, or 2½% dieldrin-40% sulfur, 8 to 15 lbs. per acre.	Toxaphene, or chlordane, 1½-3 lbs.; or dieldrin, or aldrin, ⅛ to ¼ lb. per acre.

[1]A spray concentrate containing 2 parts toxaphene and 1 part DDT.
[2]The maximum dosage for weevil control.
[3]3% gamma benzene hexachloride-5% DDT-40% sulfur.
[4]3 parts gamma benzene hexachloride-5 parts DDT.
[5]2% gamma benzene hexachloride-10% DDT-40% sulfur.
[6]TEPP may be used in mixtures with other sprays for aphid or red spider "knockout."
[7]Aramite may be used in mixtures with other sprays for red spider "knockout."

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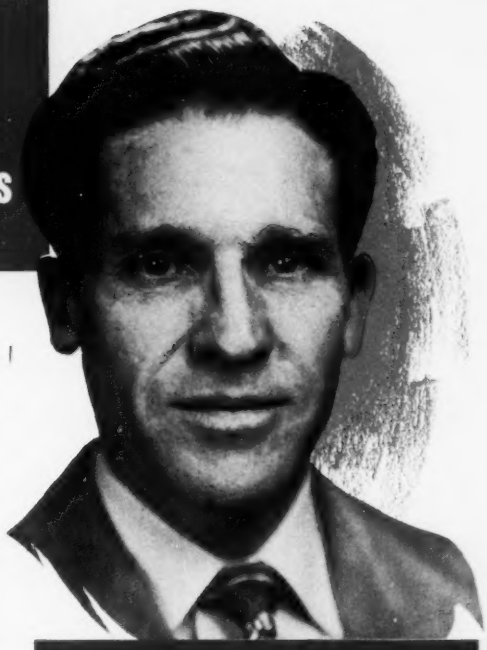

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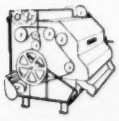

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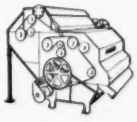

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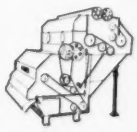

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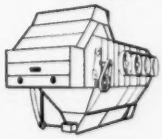

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